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Modified Machine Line for Heavy Twelves and Sixteens

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If one has time to read between the lines of this article he will find two stories in one: a factual account of advanced cylinder block practice and a means of adapting mass production principles to small lot manufacture

MASS PRODUCTION methods have been modified to meet the conditions of products built to varied specifications at the plant of the American LaFrance and Foamite Corporation, Elmira, New York. Production lot quantities are usually small, ranging from two to fifty units of a single part. The work may be classed as medium to heavy machine work, requiring A-1 mechanics and extreme accuracy with the minimum of tooling.

Prior to 1931 LaFrance fire apparatus was equipped with a six-cylinder engine having a heat-treated aluminum crank case with separate T-head type cast-iron cylinders. These could be handled without special loading or conveying equipment, and still attain satisfactory production costs.

In 1930 it was decided to change to 30-deg. V-type 12- and 16-cylinder engines with 4-in. bore and 5-in. stroke, the cylinder block and crank case being cast as one nickel-iron unit. These engines peak at 240 and 340 hp., respectively, at 2,800 r.p.m. Crank case castings weigh approximately 700 lb. for the 12-cylinder and 900 lb. for the 16-cylinder. There are 230 holes in the 12-cylinder block and 288 in the 16-cylinder block.

The company also decided to build both the 12- and 16-cylinder engines over one line of fixtures. To that end the engineering department furnished engine designs whose front, rear and center sections were common to both models.

The front, a center and a rear section produced a 12-cylinder engine, the front, two centers and the rear section made up a 16-cylinder block.

With this design was developed a progressive machining line having a floor to floor time on any operation of 43 min. The machine line in conjunction with our other miscellaneous machines also became the main artery for the other heavy work, such as cylinder heads, fire pumps, pump heads, transmission cases, axles, aërial raising frames, etc. By judicious planning and careful balancing of machine loads it has been possible to make a very decided saving in the handling of products due to this new machine line and its incentive of continuity in production.

Among the novel ideas of the machine line are the roll-over carriages and their tracks designed specifically for the drilling of the heavy crank cases. Faced with the necessity of using the same multiple- and radial-drill equipment for other work, the company decided that the track under the machines should be permanent, once it was laid down, and that the return track in the aisle and the cross-over carriages should be removable. Accordingly, at the end of each crank-case run, floor

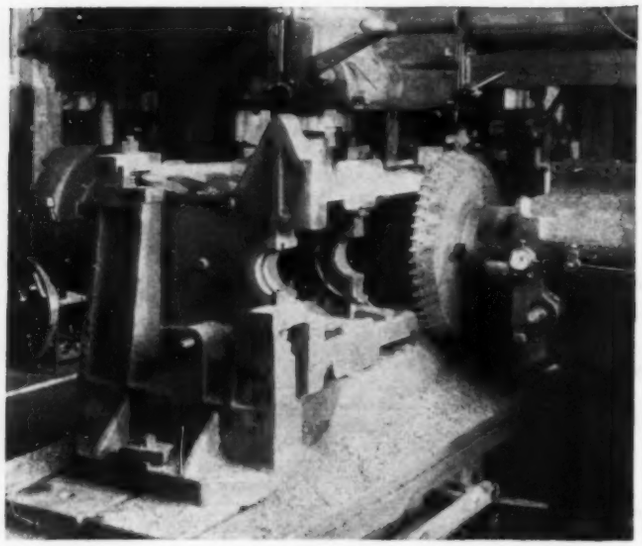


Fig. 2—First milling operation on crank case and cylinder block

bolts are removed and the return track is lifted in sections by the crane and set in a storage position between the rear of the machines and the wall of the building where it is again bolted down. The track for the cross-over carriage at the radial end of the line runs from the wall to the machine aisle. Thus it is necessary only to push the roll-over fixtures on the cross-over carriage and transfer them to the storage track in back of the machine line.

In order to obtain the utmost efficiency of the multiple and radial equipment when machining parts other than the engine crank cases, several surface-plate-type carriages were built to run on the track, thus overcoming the necessity of ripping up the track under the drills in order to use the platen type of stationary tables. This again provided the possibility of combining multiple drilling and radial work without removing the piece from the fixture.

The rear motor support plate is cited as a suitable example of this combination. Twenty-six holes are drilled, two holes are reamed and the starting-motor register is bored to a 0.002-in. limit. The work is located in a jig placed on a surface plate carriage and drilled on the multiple-drill press. The carriage is then rolled along the track to the radial where the dowel-bolt holes are reamed and the starting-motor register bored with Kelly block-type tools, the bar being piloted top and bottom. Here arise savings not possible in previous methods, further justifying the installation of the progressive machining line. The layout, Fig. 1, describes the machines and operations on the cylinder blocks.

The cylinder block rests on three-point locators for the first milling operation. There are two chipping pads at the extreme end of the top of the block on one side, obtained by laying the gage bar between the vees of the end cylinders. A cored hole of suitable size was provided in each end jacket wall to permit the use of this locating bar. Longitudinal casting variation is equalized by a spring cone point plunger sliding in a hardened and ground bushing. This plunger positions the chipping fixture endwise, taking location from the side walls of adjacent cylinder barrels. Admission is obtained through the water pump discharge opening in the jacket wall.

The bottom locator is attached to the case at the central portion of the oil pan flange. This pad is chipped with a fixture which takes position from the surface of the oil pan flange and is squared by equalizing expanders in the end main bearing cores. Thus, means are provided for aligning the casting so the centers of the cylinder barrels intersect the centers of the crank bores.

Casting locators are chipped and checked at the foundry to insure over-all machinability, and gages are provided to ascertain that bores and machined surfaces will subsequently finish from the locating points as chipped. The inspector rechecks on receipt of castings at the plant

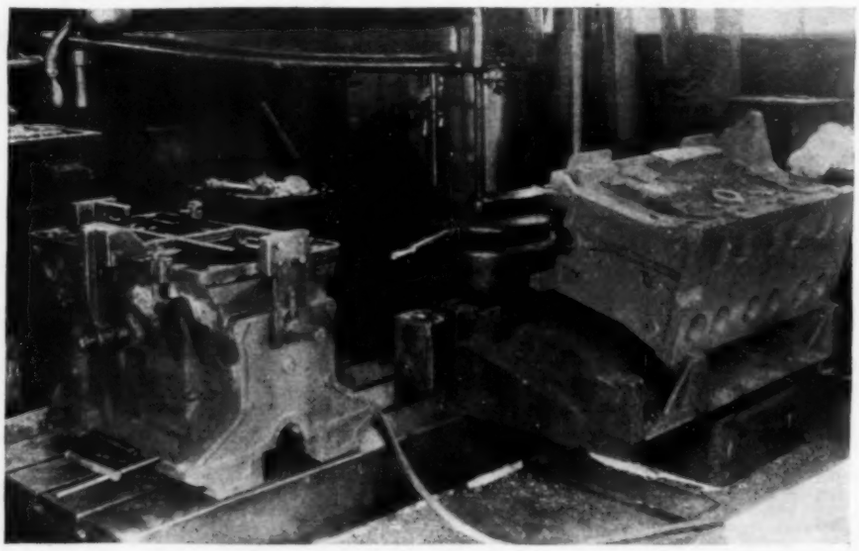
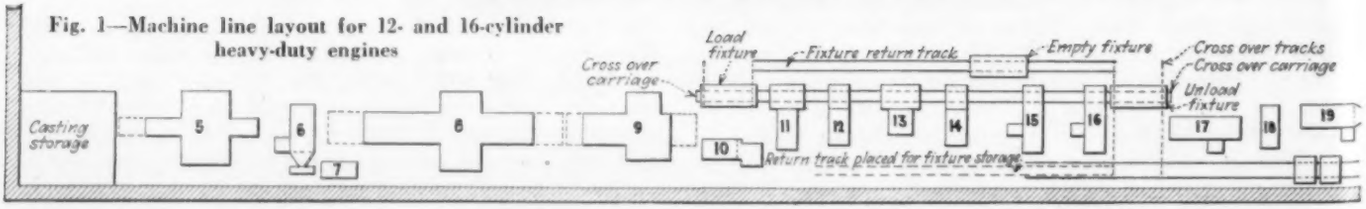


Fig. 3—Drilling the locator holes that are used for registration in subsequent operations

Fig. 1—Machine line layout for 12- and 16-cylinder heavy-duty engines



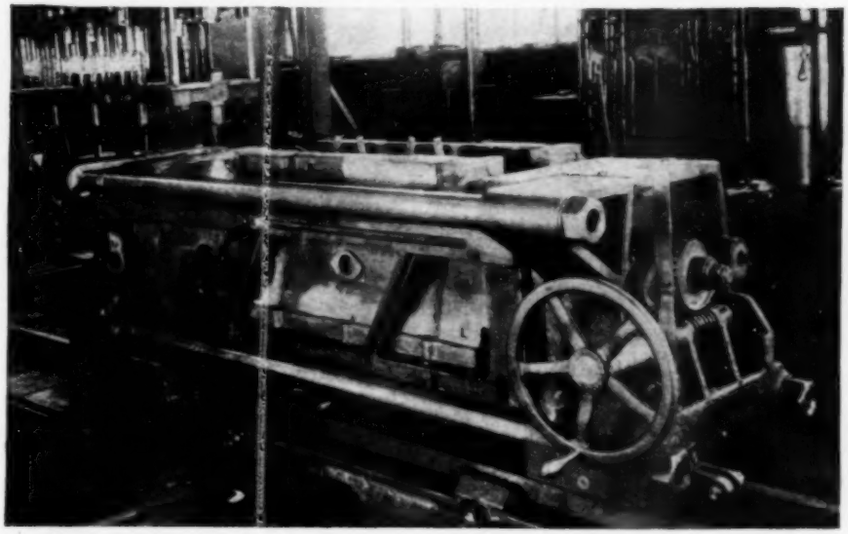


Fig. 4—One of three roll-over fixtures used on the drilling line

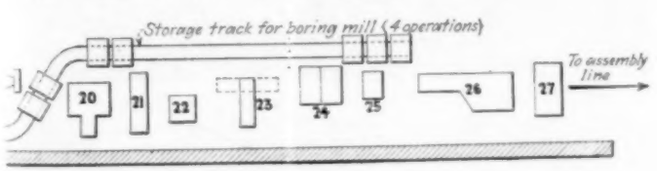
10 per cent of each casting shipment, thus providing reasonable assurance that castings as received will be usable when machined.

Castings go directly to a snagging room where all feather edges and particles of burnt molding sand are chipped, ground, scraped or filed from pockets, oil wells and walls of the crank chamber. The case is then pickled for twelve hours in hydrofluoric acid to break down the core sand remaining in the jackets.

After draining and washing with boiling water, the case moves to the heat-treat department where it is normalized to remove casting strains. It is then taken to the sand blast room, where the jackets are blown clean with compressed air and the case sand blasted all over. Next it is spray painted all over with crank case sealer, after which it progresses to the machine shop, to a storage point adjacent to the first milling operation.

Equipment Layout and Operations

No.	Machine	Operation
5	8-ft. Ingersoll slab mill	Mill top, bottom and one side
6	No. 2 Bickford radial drill	Drill and ream 2 locating holes and assemble core plugs
7	Special fixture	Water test
8	16-ft. Ingersoll slab mill	Mill both ends
9	8-ft. Beaman & Smith slab mill	Mill bearing channels and one side
10	4-ft. Cinn.-Bickford radial drill	Drill and ream 46 holes that multiples could not handle
11	42 spindle Natco multiple drill	Drill 40 holes in bottom
12	34 spindle Natco multiple drill	Drill 29 holes in water pump side
13	42 spindle Natco multiple drill	Drill 32 holes in top
14	34 spindle Natco multiple drill	Drill 17 holes in generator side
15	4-ft.Cinn.-Bickford radial drill	Chamfer and tap holes on generator side and bottom
16	4-ft. American radial drill	Chamfer and tap holes on water pump and side and top
17	6-ft. American radial drill	Drill and ream bearing cap dowel holes, etc.
18	24 spindle Natco multiple drill	Drill 22 holes in front end
19	6-ft. American radial drill	Drill 11 holes in rear and tap 33 holes in both ends
20	4 spindle Moline Hole Hog	Cobore, rough bore, finish bore and ream cylinder bores
21	4-ft. American radial drill	Bore 4 distributor bores
22	Dry ice container	Assemble cylinder sleeves
23	26-in. Barnes drill	Hone cylinder sleeves to size
24	Fluid tanks (forced pressure)	Wash completed casting
25	Platform	Lap and assemble main bearing caps
26	No. 32 Lucas boring mill	Rough, semi-finish and finish bore main bearings
27	Platform	Inspect.



The fixture shown in Fig. 2 is designed to take either a 12- or 16-cylinder case. The fixed locator and pedestal clamp is at the rear end of the case. The movable pedestal, clamps and locators are changed according to the length of the part.

All movable parts of the fixture requiring positive location are provided with hardened and ground dowels and bushing. All machined locating portions of the fixture not in use are protected from damage by cover plates. A set-up or changeover to either model can be made in four hours.

In this first operation the case is rough- and finish-milled top, bottom and one side.

The next operations are on a radial drill. Two $\frac{11}{16}$ locating holes are drilled and reamed at diagonally opposite corners of the cylinder head deck. These holes give location for all subsequent operations. The jig for drilling locator holes takes location from the same three points as the chipping fixture, viz: by hardened and ground rest buttons from finished top surface; by forked locators over a hardened and ground bar located in the crotch or vee of each end pair of cylinder barrels; and endwise by a hardened and ground spring-actuated cone-point locator, fastened to the fixture and projecting through water pump outlet pad, taking position between the walls of two center cylinder barrels on one side. The jig is provided with removable slip bushings in hardened and ground liners.

The same operator drills, chamfers, taps and plugs all core holes. Holes and plugs are checked to provide that all plugs shall set one and one-half threads under top surface when tight.

Some Operations Require Balancing

The next operator, in order to balance his 43-min. floor to floor time, water tests the block at a pressure of 25 lb. and then mills the ends on the slab mill, machine No. 8. Here, the case takes location from its finished top face and two previously reamed locating holes. Suitable clamps and gages are provided for rough and finish milling.

The operation next in sequence is that of milling the bearing channel as well as the water pump and puralator pads on the opposite side. Milling and drilling both sides of the case enable use of the same block for right- or left-hand motors for marine work.

The fixture shown in Fig. 3 is typical of present practice. Taking location as in the preceding operation, it is provided with suitable clamps, gages and supports to mill the piece in accordance with the modern practice used on the other parts.

The next operator drills, reams and taps miscellaneous holes in top of crank case not covered by the multiple drills.

The next move calls for the case to be located in one of

Fig. 5—There is a transfer car at the end of this line whereby the fixtures can be shunted to the return track

the three roll-over carriages, Fig. 4. Top side down, it rests on hardened and ground pads and is registered from the same reamed holes used in prior operations. The case is clamped in position by two sets of draw bars inserted through the cylinder barrels, bayonet locking to the bottom of the cradle. A half cylindrical bar clamp plate, seating in adjacent main bearings, provides the means for tightening the draw bars.

There are also several novel ideas in the arrangement of the multiple jigs and carriages. The cradle of the carriage was bored for Briney registed pins and fitted with hardened and ground plates so that it could be used for either 12- or 16-cylinder engines by moving the locating pins.

These roll-over carriages are possibly the largest of their type built. In order to keep fixture weight to a miniumum approximating 1,000 lb. they were made in the form of built-up units. The end pieces which carry the revolving indexing mechanism and jig locators are ribbed castings aligned by three 4-in. diameter seamless nickel-steel tubes, with shouldered ends ground to a drive fit in the hubs of the end castings. Each end casting was bored and fitted with hardened and ground bushings and locating pin for indexing, and was positioned with relation to the lateral support bars to plus and minus 0.0005 in.

This alignment had to be close to permit the use of double index pins, one at each end of the carriage. In addition, the product of all three carriages had to be alike. All end pieces were bored in pairs and the set-up of the machine was not broken until the three pairs were finished. Jo-blocks, height gages and verniers were calibrated before starting, and the boring mill was checked for accuracy.

Each cradle was fitted with a pair of oil-hardened die-steel, dial rings. The index holes and the locating bolt holes were bored in one setting so that holes matched in any plate. These plates were made a slip fit over the cradle trunnion arms, the correct index hole was buttoned, the disks located for height, clamped in position and the dowel bolt holes transfer-bored to the cradle.

The locating holes for positioning the jigs with relation to the cradle register pins had to be located in the end pieces in order to maintain a fixed relative position to the revolving cradle in its different drilling positions. This was accomplished by boring and bushing two fixed locating holes at each end of the top face of the cradle with relation to the register pin holes used to locate the work. A master jig with bar and bushings was made. The assembled carriage was moved to a position on the track under a radial drill where the holes were drilled and bored, after which the Briney bushings were ground and press-fitted to position.

The product from these three cradles is so closely interchangeable that no difference can be found on the produc-

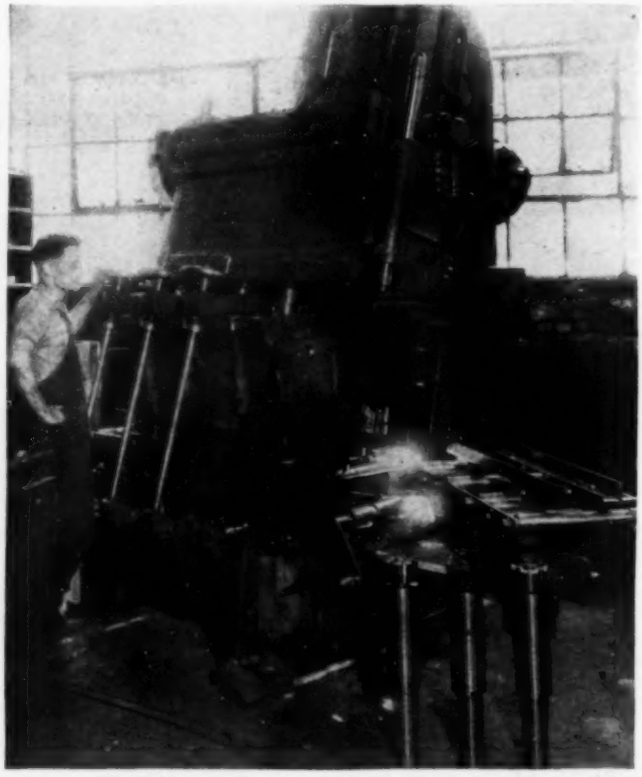


Fig. 6—The Hole Hog cylinder borer finishes alternate bores, the cylinder block being indexed accordingly

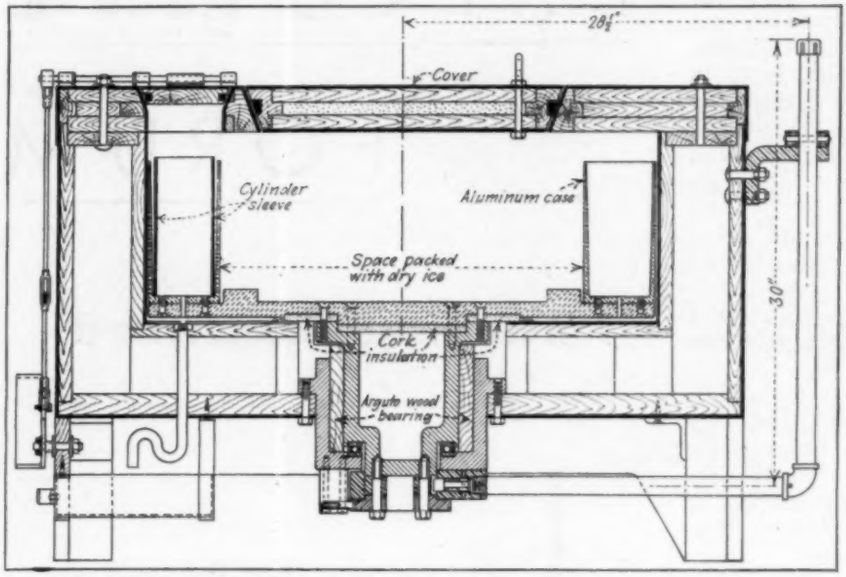


Fig. 7—Revolving sixteen-place fixture to shrink cylinder liners by refrigeration

tion line. Not a single case was lost on the initial run. The fixture, with a 16-cylinder case and clamps, weighs a ton. It is mounted on preloaded ball bearing wheels, one side on a vee-shaped rail, the other on a flat rail, and can be pulled along the track by one finger. The work and cradle can be revolved easily so that it requires but one man per fixture for all drilling operations, except under the radial drill at the last station where the jigs for the right- and left-hand angular holes are handled. At this station two locating holes are drilled and reamed in the bottom face for use on the Moline cylinder boring mill when boring the cylinders.

A view of the drill line showing carriages and jigs for the various operations, is shown in Fig. 5.

The case is next removed from the fixture, placed on rest pads on a radial with a plate jig locating from the Moline dowel holes. The bearing cap and shell dowel holes are drilled and reamed, as are also the holes for the oil seal and oil lead.

The case then passes to a No. 13 Natco where it stands on the rear face in guides against a locator on the column. Eighteen holes are drilled in the front end. This jig equalizes from the bearing channel locks and the head surface. It is made of heat-treated aluminum and fitted with hardened and ground wear strips and liner bushings, making a light, accurate, substantial jig, easily handled by one man.

The next operation is done on a radial. It consists of chamfering and tapping holes on front end, and drill chamfer and tap holes on rear end. Here a jig similar to that in the prior operation is used.

The case now passes to the Moline cylinder-boring machine shown in Fig. 6. This machine was built to order and is of the oil-gear hydraulic type having long spaced spindle bearings to overcome any necessity for piloted bars. The spindles and bearings are of such size they have to be spaced for boring every other hole, requiring two indexings per side and a reversal of the case on a revolving stand.

The cylinder-boring machine stands diagonally in the corner of the building while curving in front and running parallel to each wall, is an industrial track with 25 cars carrying two cases per car and providing for a production lot of 50 cases.

There are four operations per block, as follows: Counterbore to square out the 15-deg. angle with the top deck and insure that the boring cutters start true with the core; rough bore; finish bore and ream.

The next operation calls for rough- and finished-boring of the four angular distributor holes. This fixture is of the rocking type, mounted on a radial drill. In its loading position the work rest is even with the platen. The fixture is provided with an elevating loading platform to facilitate locating the piece on the register pins. After the work is clamped, the fixture is rocked to a 15 deg. angular position by a Swartz jig clamp jack, thus bringing the pilot bushings into vertical alignment with the spindle head.

The cases then move on the cars to the next operation, that of fitting the cylinder liners. The engine is of the dry sleeve type and sleeves are fitted in the cylinder bores with 0.0015-in. press fit. These sleeves are fitted at the rate of one a minute through the use of dry ice refrigeration.

A special container, Fig. 7, has been developed. It consists of an insulated ice chest containing a rotating aluminum platform carrying 200 lb. of dry-ice. Mounted on its outer periphery are sixteen cast-aluminum cups, each of which holds a sleeve. This table registers by an indexing mechanism with a suitable opening covered by a spring acting top so that it is open only when a sleeve is being removed. Sleeves are first given a bath of kerosene and light clinder oil, so that when removed they will not gather frost from the warm air during the period of transfer. They are removed from the chest, dropped into cylinder bores, and, on warming up to room temperature, expand to a tight fit.

The case now moves to the honing machine where 0.001 in. is removed from the ground inside surface of the clinder sleeves. Cases are next rough-washed by a pressure kerosene bath and cleansed of all chips and abrasive. Following this, they are taken to the fitting bench where faces of bearing channels and caps are lapped. Caps are then doweled and bolted to the cases. They go next to the boring machine and all main bearings are rough-, semi-finish- and finish-bored for prefitted bearings.

This fixture is also provided with an elevating platform to facilitate centering the work on its register pins. In addition, the work supports and register pins are movable to provide for either 12- or 16-cylinder engines. All pads not in use are covered with protection plates to prevent marring of the finished surfaces.

The case now receives a final pressure distillate bath and after inspection moves directly to the engine assembly line.

EXECUTIVE FORUM

Turning Backward

Few will deny that the world is going through a period of transition in which many cherished aspects of our present civilization are on trial. Our intense mechanization has been attacked as the source of many economic ills. Is it time to admit that we've gone too far in speeding up our manufacturing processes? Or does the trouble lie with our system of credit and finance which often makes it impossible for potential consumers to secure the goods they desire? Shall we seek a solution in a reversion to the simpler handicraft methods of yesterday? Or can our increasing mechanization be brought under control? What do you think about this problem?

THE PRESENT low ebb in industry has set many men thinking. Even those high in the direction of industrial enterprises have in some cases expressed doubt as to the justification of the complicated business structures they have helped to build. Harold Wharton, President of the Channing Metal Works, had begun to question the many ramifications of our present-day mechanized manufacturing processes. This thought was uppermost in his mind when he chanced to meet Bill Holland in the lobby of the New Era Hotel.

"Bill, you're sort of an economist, aren't you?" asked Wharton.

"I've never been called one before," said Bill, "but I might plead guilty to some amateur thinking in that direction. What's on your mind?"

"Everytime I open a newspaper or a magazine, I see an article on prosperity or the lack of it. Many of the writers have good arguments, but their conclusions are entirely contradictory. Some want the government to appropriate vast sums in public building. Others advocate strict economy to lighten the tax load."

"It is puzzling," Bill agreed, "I doubt if anyone has hit upon the real solution."

"One proposal in particular interested me," said Wharton, "that is, to call a halt in the complication of mechanical development, to simplify our methods of working, to live in smaller communities, and to resume some of our forgotten handicrafts.

"That's a visionary picture," said Bill, "and one that will never materialize. We haven't the power to turn back the hands of time, and even if we had, we probably wouldn't like the result."

"But we've reached a tempo in living that seems quite senseless," said Wharton. "Men tumble out of beds and rush to work in response to a factory whistle. They speed up their machines to turn out more product for a market that's already glutted. What do we gain by this mad rush when thousands of others are idle? Certainly life was more enjoyable when people took things easier and lived more leisurely."

"Everything looks better in retrospect," said Bill. "We like to picture the past as being leisurely and comfortable. We forget the famines, the pestilences and the lack of security against lawlessness. The only source of power in those days was man-power. Work handled easily today by machinery was back-breaking drudgery a century ago."

"I'm not advocating that we scrap our advances in science and invention," said Wharton. "But this increasing interdependence of one community on another and all the other intricacies of this age seem to have created more trouble than they're worth. We spend so much time worrying about business and production that we don't take time to enjoy the fruits of our efforts."

"Largely because we demand more today than ever before," said Bill. "It takes an intricate system to satisfy our desire for products from the four corners of the earth. The solution is not to go backward but forward. Our complex civilization cannot be separated from our mechanical development. We must learn to control both and make the machine an obedient servant. The trouble is that mechanization has outstripped the methods for distributing its output. Our economic problems need the same scientific approach we apply to our technical problems. Then we'll be on the right track."

"I'm not sure that it won't lead to the simpler living methods of the past," said Wharton, "rather than to still further complexities."

Discussions Of Former Subjects

Enforced Retirement

Wise indeed are those corporations that have a systematic program for the retirement of employees including major executives. I am most certainly for a plan of compulsory retirement with no ifs or buts, against the plan of making it elastic enough to avoid termination should a man be capable of carrying on.

By instituting such a plan along with a pension plan certain advantages will accrue. (1) It will make the way open for promotion and develop a creative competitive condition. (2) It will add to the reputation of the company in the recruiting of young men of executive caliber. (3) It will also act as a reward to the retiring executive for his long service.

This is a rapidly changing world; new thoughts, ideas, morals and ethics are forever being propounded. A man of seventy cannot compete with the younger man in absorbing all of them. And he should, if he has the company's interests at heart, be willing to step down gracefully from his post and make way for another. —DANIEL H. FRUCHTMAN.

Shifting the Burden

Both the importance of burden and the advantages of multiple shifting tend to be exaggerated. Folk talk glibly of the dead weight of the nonproducer, but if the total expenditure (wages, material, and burden) of the average shop were examined, it is probable that burden would not form more than 25 per cent of the whole. An exhaustive investigation into the cotton industry, when a similiar project was mooted, gave a possible maximum saving of 4 per cent on the total cost if double shifting were introduced.

Savings per unit of output would accrue in expenditure on maintenance, renewal of plant and taxes, but on items such as power and supervision, little if any economy could be effected. In any case, it is one thing to decide that a saving could be made, and a different one to say whether such a change should be undertaken. When all the factors of reorganization, disaffection of labor, and additional supervision are weighed, it is doubtful if many employers would consider a problematic return of 4 per cent as suitable compensation.

For "shifting the burden," let us substitute "spreading the burden," and we should find that switching over of some of the energy and thought, now given to reducing costs, to the task of better salesmanship and more intensive publicity, would yield a profitable return.

—T. H. HARGRAVE,
Bolton, England.

Itemized Pricing

Service departments, engineering of special features, setting-up, and demonstrating have been big items in machinery sales and a bone of contention for many years. It is unfair to make all customers pay for the shortcomings of the few.

It is on a par with the chain store vs. the old corner grocery that extends credit to everyone. At the chain store, every one pays cash and carries the groceries. For frills, such as delivery, you pay extra. The old corner grocery charges 20 to 35 per cent more whether you pay cash or not. The cash paying customer pays extra that the grocer may come out even on his extension of credit.

One machinery manufacturer at least has worked out a plan to solve the difficulty. The machine as standard has a stated price. Leave off certain things and the cost is increased, because it is special and entails certain extra work. Put on some attachments, and an extra charge is made. If the customer wants a special attachment that is not designed, he pays for the engineering, the design, the experimenting, and the attachment, plus profit.

If servicing is needed, a price is made, unless there is some fault in the machine directly traceable to the manufacturer, when the service is free. Why buy a taper attachment and a profiling or relieving attachment built in when only a production lathe is wanted? Why should the purchaser pay for more than he wants, or why should the manufacturer give more than is paid for?

The firm that first adopts the chain store method of selling, with the exception that installment selling be inaugurated, the purchaser to pay the cost of carrying the account, will find itself in the enviable position of the chain store today as against the old corner store. —C. G. WILLIAMS.

If Salesmanager Wallace had suggested his price breakdown plan in 1929, President Graham could have sat upon it with a clear conscience. There really wouldn't have been any point to it then. Few were scrutinizing prices more than cursorily—nobody really cared about hunting out small economies.

But Salesmanager Wallace is clever. When going gets tough, would he slash prices all along the line, give all the profits away on what business he might still be able to scrape up on a falling market—and satisfy nobody after all? He would do nothing of the sort; not when he's brainy enough to fix it so those who want to economize badly enough can take their machines, less this service and that, supply what's lacking themselves and be glad of the chance.

—WILL ARMOUR.

The Up Grade

It is equally as unfortunate that Reynolds has had so short a practical experience as it is that Boyle has not availed himself of the opportunity, which must have been his, of obtaining technical training.

To the employer, the first eight years of Reynolds' practical experience is equivalent to twenty years of the practical man's experience—after which Boyle will realize that he is unsuited for further promotion, and that he is becoming a trifle out of date. At the end of eight years, Reynolds will have become a leader who can look his men in the face and tell them what to do because he knows why it is done.

I once enjoyed a demonstration of the comparative leadership of two men, one technically trained, the other a reliable practical man. The job in hand was the breaking up of a cast-iron bed plate for scrap. Boyle knew that a great many heavy blows were needed, but Reynolds knew where they were effective. In winter, the practical man may be tolerated, but on a warm afternoon the wielders of the sledge-hammer prefer the guidance of a technically trained man.

—D. Q. DUNSTONE,
Hetton-le-Hole, England.

CLEANLINESS as a

INVESTIGATIONS of numerous cases of skin infection among workers who come in contact with cutting oils and industrial dirt have convinced me that in the majority of instances a rigidly enforced program of cleanliness will go a long way toward preventing these diseases. Though such materials may bring about infection, they are not the primary cause of skin inflammation. Dirty hands or soiled clothing rubbed across the skin usually start the trouble. In factories and shops where the surroundings are scrupulously clean and employees are particularly careful about personal cleanliness, the number of cases of skin irritation has been definitely lessened. Boils and pimples, which are more prevalent than any other form of occupational disease, may be largely prevented by simple and inexpensive measures based on soap and water.

Season, temperature, humidity, working conditions and kind of skin play an important part. It has been observed that when workers in industries in which cutting oils or dust of various kinds are found, become soaked with perspiration, there is an increase in skin troubles, and that dry-skinned persons and persons troubled with excessive oil are more susceptible than normal persons. Probably part of the answer in regard to heat and perspiration lies in the fact that more dirt is taken up by the perspiration; that the person in an attempt to keep the sweat out of the eyes and off the hands, brushes his hands and arms across each other, across the forehead and the back of the neck, thus rubbing in the dirt. If the substance is toxic in itself, so much the worse. Moreover, if work clothes are filled with dust and dirt, and then become soaked with perspiration or oil, every movement of the body, as well as the rubbing with the hands, grinds in the irritating substances.

A Natural Defense

Under ordinary conditions, the natural oil of the skin sets up an adequate protection against irritants. But when the skin is smeared with grease solvents like benzine, gasoline or kerosene, or when it is cleaned with harsh abrasives like pumice, this defense is destroyed and the worker is consequently more susceptible to skin troubles.

With the oily barrier broken down, dirt and other foreign substances cling to the openings about the hairs, and the skin begins to itch. To relieve the irritation, the sufferer usually starts to scratch the place with his fingernails or to rub it with his arms or clothing. Sometimes he picks up a piece of rough burlap or a bit of waste, and brushes it across his face. This is dangerous, because burlap and waste usually contain bits of metal and dirt which may break the skin and open the way for infection. It has been found that a magnet will pick up plenty of such particles after the skin has been wiped with waste. But even if a clean cloth is used, rubbing is likely to break the skin so that bacteria have a chance to gain entrance.

Warning against scratching and rubbing, however, is but one step among the measures of prevention. The precautions should start before employees are hired. In industries where workers are exposed to known toxic substances, physical examination of applicants should be required and those with skin diseases excluded. Periodic examination of employees should also be part of the regular routine. In the case of paraffin workers, it is necessary to conduct a daily examination of the skin.

The simplest method of discovering whether an applicant or an employee reacts to certain toxic materials is by means of a patch skin test. This test is made by soaking a one-inch square of sterile gauze in a solution of the suspected substance, and then strapping the saturated piece to the inside of the forearm with adhesive plaster. If the skin becomes red after a period of from twenty-four to forty-eight hours, a positive reaction is indicated. If no change takes place, the reaction is negative.

Whenever it is evident that a worker has a susceptible skin, whether this is due to a systemic condition, to a natural dryness of the skin, or to sensitization of the skin following repeated exposure, the person should be transferred to a non-exposure task.

Those who work with toxic materials should be protected as far as possible from actual contact. When using acids and alkalis which destroy the skin, protection is afforded by employing a closed process wherever practicable, and covering the body with protective clothing. Gloves, aprons, and garments that fit tight at the neck, wrists, waist and ankles are necessary safeguards for the skin when these destructive substances are used. Leather aprons prevent abdominal irritation, and a forehead band of clean cloth soaks up perspiration and keeps the wearer from wiping his brow with soiled hands or clothing. A supply of old, soft cloths should be kept on hand so that clean headbands are always available. If any of the harmful material reaches the skin, it should be removed as quickly and as thoroughly as possible.

Find and List Causes

Since occupational skin diseases so often cut down the efficiency of workers in industry, one should be familiar with the main occupations that are exposed to skin irritants. Exact information is difficult to obtain because almost any foreign substance may cause a skin irritation, with resultant inflammation, if it comes in contact with the skin in sufficient quantities over a sufficient length of time. Even hot water and mild soap, which are harmless and non-poisonous, have been known to irritate the skin when the contact is continuous. But a comprehensive chart, listing every chemical used in the factory or plant, will form a satisfactory check-up on recognized irritants and substances. This list should be kept up-to-

W. R. REDDEN, M.D.
Director, First Aid, New York Chapter American Red Cross

Preventive of Industrial Diseases

Cutting oils and compounds have long been blamed for various skin disorders. With a new conception of some of the causes of skin irritations one finds these oils and compounds to be relatively harmless. Scrupulous cleanliness is indicated as the best preventive measure

date with chemical analyses of all new materials adopted.

It is certain that some of the materials used in cutting oils and compounds have an irritating effect on the skin, but the real problem of prevention of oil boils and pimples, or even blackheads, has little to do with actual skin irritants. Back in 1918, the Department of Scientific and Industrial Research; Advisory Council of London, reported that oil rashes are of two kinds: the first is due to the plugging of the small glands at the root of the hairs on the arms and legs of the workers; the second to mechanical injury to the skin produced by metallic particles suspended in the cutting lubricant.

Plugging of the glands of the hair follicles, primarily, is purely mechanical. A mixture of oil and dirt blocks the minute openings of these glands and sets up an inflammation round the hair. The inflammation commenced in this way may lead on to suppuration or abscess formation. If many hairs are affected, the arm presents an appearance of a crop of raised, red spots with a black spot in the center; or, if the inflammation has gone as far as abscess formation, a yellow head.

Infection Through Broken Skin

Mechanical injury to the skin by metallic particles occurs chiefly on the hands where two surfaces are rubbed together; that is, the skin between the fingers. Injury to the skin may also be produced on any part of the hands or arms by wiping with a cloth or rag while the hands or arms are coated with a film of fluid in which metallic particles are suspended. Injury to the skin allows germs to enter and causes septic infection.

The work of McConnell of the United States Public Health Service shows clearly that it is not necessarily the oil or the contents of the cutting compounds that cause pimples, boils and blackheads, but rather that it is the rubbing in, during the working hours, of the dirt already on the skin before work begins. He definitely demonstrated that if men thoroughly scrubbed up before work, then applied lanolin or some other oily substance, and repeated the process after lunch with a clean-up before lunch and at the end of the day, no new cases of oil dermatoses developed, and that the same procedure cleared up 80 to 90 per cent of the cases then in existence among the industries investigated.

Special Soaps and Antiseptics

This point is extremely important, for there are industrialists and even physicians who still believe that the prevention of this type of dermatosis calls for some special soap of so-called high germicidal action or for the addition of antiseptics to the cutting oils or compounds. They take for granted that the main trouble comes from organisms that have contaminated the oil, and lose sight of the fact that no germicidal substance known to man has been demonstrated to sterilize the regions under the nails where lie a variety of pus-forming organisms. It is probably these germs that are the cause of much of the secondary infections, as finger nails are vigorously used to scratch irritated places—plugged, distended and inflamed by foreign material.

Furthermore, it is easy to lose sight of the demonstrated fact that these pimples and abscesses are not necessarily infected. Careful culturing by capable technicians has shown many to contain no germs. There is nothing unusual about this, because after all, any irritating substance that contacts the skin or enters through the openings of hair follicles and oil glands may produce the whole chain of inflammatory reactions from preliminary redness to abscess formation. There is sterile pus in no way related to infecting agents.

This is not an attempt to discount sterilization of cutting oils or the removal of solid foreign matter from them which might cause skin injury and subsequent secondary infections. Of course, the oils should be cleaned before re-use, and of course they should be sterilized.

The industrialist who faces the problem must decide what method to use, but his decision should not be based on a single bit of evidence. He should first obtain an

unbiased view of all the known facts, demonstrated through carefully controlled experiments over a sufficient length of time and with a large enough group to prove something.

The types of experiments or research which are not properly conducted, that is, not properly controlled, are to our mind the most misleading bits of evidence that can be presented. They are not only worthless, but they are harmful in that they misrepresent the true situation. Before an attempt is made to try out any one of the innumerable methods for the prevention of industrial dermatoses, the simple methods of personal and environmental cleanliness, such as we shall outline later, should be given a thorough trial under adequate supervision. Then to these should be added the proper handling of oils for re-use. The re-used oil should be freed from metallic particles and should be sterilized.

Cutting Oils Disinfect Themselves

There is evidence that cutting oils that have been used come through with a decided germicidal action—so much so, that it is recommended that new oils or cutting compounds be mixed with the cleaned old ones in order to distribute to the new this disinfecting quality which has resulted from exposure to high temperature.

For cutting oils and compounds, methods of preventing skin irritations should include the suggested handling of oils for re-use and supervised washing with proper equipment. To insure thorough cleanliness, adequate facilities must be provided. Running hot water and a plentiful supply of soap and individual towels should be in every washroom, with enough shower heads so bathing will proceed quickly at all times. In addition, each worker should be equipped with a bristle brush. This brush must be soft. Harsh bristles will irritate the skin.

Lavatories, toilets and locker rooms should be in charge of a cleaner whose sole job is to keep these places spick and span. Many concerns have found that it pays to employ a "scrubber" who scours the skin of those who have been exposed to oils, dust, and dirt during their work.

A Routine of Protection

On the employee's part, the routine of protection should begin as soon as he has changed his street clothes for working garments. First a scrub up, then an application of castor oil, lanolin or some other oil, so that the exposed skin will be covered with a protective film. Another good scrubbing before lunch, and after the meal a repetition of the morning program of washing and oiling. The day's work ends with a final scrubbing and an application of oil or of some mild lotion.

Workers should be taught to rinse off the oil, etc., under running hot water with the use of mild soap, rather than to use the cutting compounds for cleansing purposes. This holds true for the use of kerosene, gasoline, etc., as before mentioned.

Dr. Albert S. Gray, director of the Bureau of Industrial Hygiene of Connecticut, says, "We feel that if proper washing facilities are provided and someone of authority is delegated to see that they are used, oil dermatitis can be readily controlled."

Dr. Taylor, director of the Medical Department of the General Electric plant at Bridgeport, has eliminated oil dermatitis from the plant by insisting on proper washing and by banishing harsh cleaners and abrasives from the washing rooms.

Care of work clothes is a vital factor in the preventive measures. Employees should be provided with washable uniforms which are laundered either by the workers themselves or by the company. The American Rolling Mill Company tried this out with men handling sheet metal and found it eliminated accidents. Some companies have found it worth while to establish a laundry service to wash outside work clothes, underclothes, and towels used by employees. Certain it is that work clothes should always be changed at night for street clothes and should be hung in thoroughly aired locker rooms. This routine, as well as the bathing and scrubbing, should be under supervision. With a well-arranged system, the short periods devoted to personal cleanliness will bring ample reward in better health and greater efficiency.

Supervision of personal habits, however, is not sufficient protection. A system of regular cleaning should be inaugurated throughout the buildings. Walls, floors, benches, machines, and other equipment must be kept clean so that the air will be practically free from flying dust and dirt and the worker will be less likely to come in contact with chemicals which might irritate his skin. If the walls are painted a light color, the dirt will be instantly apparent and can be removed at once. If the floors are constructed of materials that shed dirt, cleaning becomes easier. Machinery, too, should be painted in light tints so that the dirt can plainly be seen.

With such simple methods of personal and environment cleanliness, industrial skin diseases can be prevented and in many cases cured.

• NEXT WEEK •

Time was when the engineering department passed the buck on surface finishes to the shop, and many a shop and sales department headache could be traced thereto. Since the surface finish situation, even now, continues to cause interdepartmental irritation, it is really high time that it be cleared up. In next week's issue we shall publish an authoritative article on the designation of surface finishes on drawings.

Subject to outside okays and the thousand and one things that may cause last minute changes, we shall also publish: a clear and not too technical presentation of photo-electric, or electronic, cells in the control of industrial processes; how Soviet Russia trains her future mechanics; milling and drilling connecting rods in an aircraft engine plant; high speed production dies on the "multi-slide machine"; building electric clock motors; Reference Book Sheet on strength of external spur gear teeth.

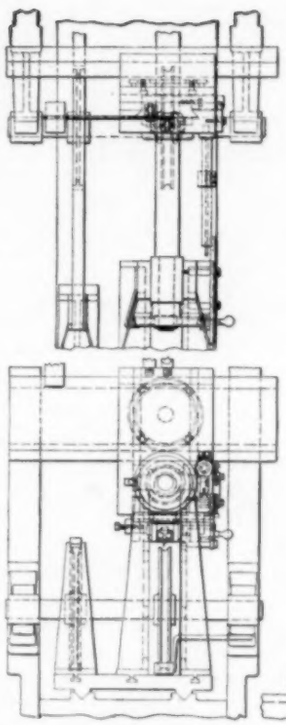
• IN A. M. •

A Puzzling Taper Groove

Last week were published a number of solutions to the problem which appeared in Vol. 75, page 466. Apparently there is wide difference of opinion as to the best method of machining a semicircular groove, ½ in. in diameter at one end and 1 in. at the other, in the periphery of a 20-in. disk. Here are a few more divergent solutions

F. A. KERSHAW

THE DEVICE, shown in Fig. 6, consists of a compound slide attached to the saddle on the crossrail of a 30-in. planer. It is controlled by a guide bar, journalled in standards mounted on the planer platten, and made a working fit in a spherical bearing in the vertical member of the compound slide.

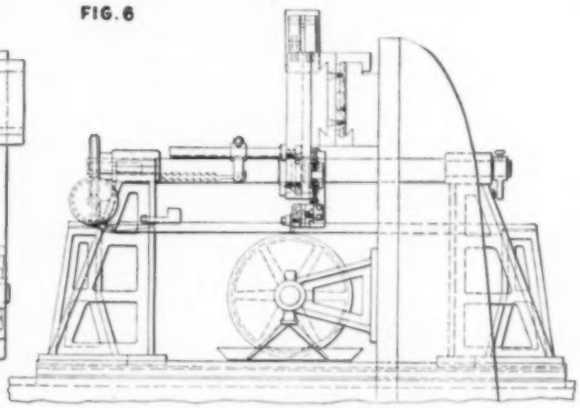


The bar is made eccentric, the eccentricity varying from end to end. At some point from the front end to allow for clearance between the journal and the spherical bearing, this eccentricity is ½ in., and at a point farther back equal to the length of the taper groove the eccentricity is one-quarter in. At the front end of the bar is a worm gear operated by a worm attached to the front standard. If the guide bar is rotated by the worm gear, any point on the vertical slide, or any point attached to it, will describe a true circle, the radius of which depends on the position of the guide bar in the spherical bearing. Thus, if the point where the eccentricity of the guide bar is one-half in. is brought to the center of the spherical bearing and the bar rotated, the circle would have a one-half-inch radius.

In the vertical member of the compound slide is another slide held in position and capable of being adjusted vertically by the setscrews that control it. This slide also carries a horizontal slide held in position and adjusted horizontally by setscrews; to this slide, a clapper box is attached for holding the tool, and is capable of being lifted to relieve the tool on the return stroke.

The disk is mounted on a cross-shaft having bearings in brackets bolted to the planer housing, and should be accurately centered with the guide bar when the center line through the two centers in the bar stands in the vertical plane. This shaft also carries a spur gear, having a pitch diameter equal to the outside diameter of the disk. A rack, carried on standards attached to each end of the platten and meshing in the gear, imparts to the disk the same velocity and direction of motion as that of the platten. Before mounting the disk on the cross-shaft, the groove should be accurately machined in a lathe to the one-half inch diameter to provide a guide in adjusting the tool for the finishing cut.

FIG. 6



Center lines should be drawn on the worm gear at 90 deg. to each other. One of these lines should be made exactly to coincide with a center line that passes through both centers in the end of the guide bar. A pointer is attached to the standard having a zero line at the same height as the center of the guide bar. This provides a quick way to bring both centers in the guide bar into the same horizontal plane which is the point at which the cuts should be started. In this position, insert a rather pointed, round-nose tool, adjust for cut, and rough out one side. Care should be taken to see that the tool does not cut too deeply as it comes down to the center, as it is likely to do if not watched, because of the width of the tool. Theoretically, only a tool having no width, if you can imagine such a tool, could pass the center without cutting too deeply on the opposite side. When the first side is roughed out, the guide bar is rotated through 180 deg. from the starting point of the first cut, and the opposite side is roughed out. The tool is now changed for one ground to a sharp point like the one shown in the sketch, with the point stoned to a radius of a few thousandths of an inch. With it, one half of the groove is finished. The tool is then changed for one of the opposite hand and the other half finished.

Power feed is provided by pins in the crank disk and a feed bar with ratchet shaped teeth to engage the

pins. This bar is mounted on a stud attached to the vertical slide and can be adjusted to change the rate of feed as desired. A better construction, however, would be to mount this stud on a bracket, extending out from the crossrail, as this would do away with the motion imparted to the stud by the vertical slide, reduce the length of the pins in the crank disk to little more than the width of the feed bar, and keep the angle at which the feed bar operates constant for any given number of notches of feed. A friction brake is applied to the lower edge of the crank disk to prevent its being turned backward on the return stroke. When it is desired to turn the crank by hand, the brake is released by throwing the weight over against the pin above it. By arranging it so that the tool will have enough overtravel at the end of the cutting stroke to utilize most of the flat on the disk, the feed will take place when the tool is free of the cut. By turning the ratchet bar over, the direction of the feed is reversed.

To guard against feeding the tool past the center, a signalling device is provided. This consists of an electric bell, dry cells, and an arm attached to the rear of the guide bar. This arm should be adjusted before starting a cut by bringing the center line that is 90 deg. back of the starting line to within about one-half inch or one-quarter inch from the zero on the index pointer, depending on whether it is to be a roughing or finishing cut, then swinging the arm around until the points contact, and clamping it in that position. The vertical slide is counterbalanced to relieve the guide bar of its weight. The standards that support the bar are made double to permit the disk to pass between them, thereby, shortening the bar and giving greater rigidity for a given diameter of bar. To supply coolant to the tool, the disk is run in a pan supported clear of the table by a bar attached to one of the cross-shaft brackets.

GEORGE D. TAYLOR

Neither of the solutions originally given seems to meet the requirements of the job. As an accurate taper groove is wanted, I would do the job in the following manner: Two disks are used, as shown in Fig. 7, and six taper reamers, the flute diameter of the smallest one at the small end to be $\frac{1}{2}$ in., the diameter of the large end of the largest reamer to be 1 in.

As shown in Fig. 7, the segment is divided into 6 spaces. As the circumference of a 20-in. circle is 62.832 in., let us avoid fractions and call the circumference 64, and as the flat part is about $\frac{1}{4}$ of the circumference, we may call 48 in. the length of the segment. This divided by six will give us a length of 8 in. for the cutting length of reamer blades. Actually they would be better if they overlapped $\frac{1}{2}$ in. at each end.

The diameter of the small end of the reamers will be $\frac{6}{12}$ in., $\frac{7}{12}$ in., $\frac{8}{12}$ in., $\frac{9}{12}$ in., $\frac{10}{12}$ in., $\frac{11}{12}$ in.; the diameters of the large end of the reamers will be $\frac{7}{12}$, $\frac{8}{12}$, $\frac{9}{12}$, $\frac{10}{12}$, $\frac{11}{12}$, $\frac{12}{12}$ in. respectively. This in effect would be a taper reamer 48 inches long. The flutes should be helical and unevenly spaced. The reamers are held and guided by the part D (see Figs. 8 and 9), which slides back and forth in a groove in the base A and is held in place by gib E. To place and remove each reamer easily from the part D, the reamers are made about $1\frac{1}{32}$ in. in diameter at the large end, and are held in place by the two collars S and S'. The hole could be bushed for the smaller reamers, if desired.

On the small end of each reamer is a pilot beyond the

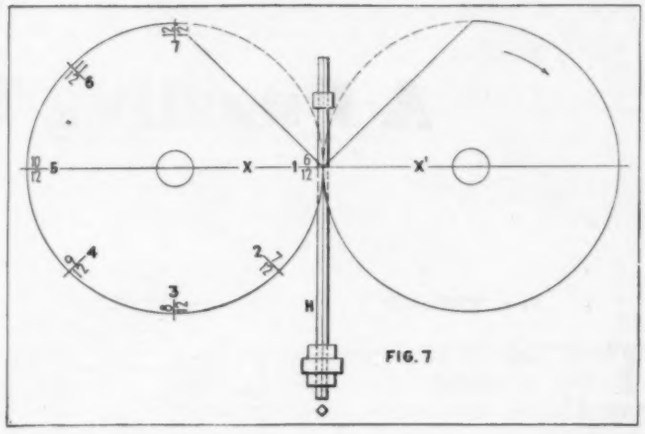


FIG. 7

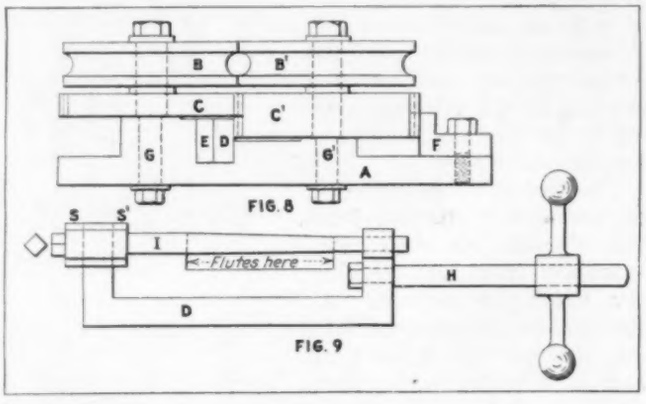


FIG. 8

FIG. 9

flutes. The reamer is supported at both ends by the part D (see Fig. 8) which carries a rack in mesh with gear C' which in turn is in mesh with gear C. The part D is drawn along by a hand wheel on the threaded rod H. Fig. 8 is a cross section on center line X—X' of Fig. 7, with the disks B and B' machined with $\frac{1}{2}$ in. round grooves in the periphery and pinned to the gears C and C'. An alternate construction is to key disks and gears to the studs G and G'. As shown in Fig. 7, the part D is advanced by the handwheel at the same time the reamer is turned either by hand or power until Station 2 reaches the center line $X\ X'$, and the reamer is cutting to the size $\frac{7}{12}$ in.

A short piece of rack F is then meshed with gear C and clamped fast. The collar S is loosened and the reamer removed. Gib E is removed allowing the rack of D to fall out of mesh with gear C; this will allow D to be returned to its first position (see Fig. 6). D is then put in mesh with gear C', gib E is replaced, a new reamer is inserted, rack F is loosened, and the set-up is ready for the succeeding cuts. A finish cut around might add to the accuracy of the job. Last but not least, give the job to a good machinist.

FRANCIS W. SHAW
Gear Consultant, Heywood, England

To determine the interference between the cutter and a groove of the correct shape is an extremely difficult mathematical proposition.

May I suggest that the least costly way of deciding whether or not the scheme devised by your querist will give a near-enough result, is to try it out. To my mind there does not appear to be a shadow of a doubt that by

proper procedure, the disk will be produced at the first attempt. I say this after drafting out an exaggerated case which indicates that by proper cutter setting the interference can be rendered almost unnoticeable.

Let the disk be initially turned oversize, say to 20⅛ in. diameter instead of 20 in. Turn in it a groove of the correct minimum section as a guide to setting the cutter. Rough out the rest of the groove in any convenient way. To do this, the disk might be set eccentric on the lathe faceplate, and the already turned groove merely deepened. The groove could be widened to lines scribed on the periphery by easy steps in a milling machine using radius mills of different radii.

Now set the blank and cutter as the original sketch indicates. Adjust the cutter by degrees both radially and endwise until it nearly touches the surface of the turned groove. Apply the feeds, rotary and longitudinal, the relation of these having been calculated from the groove depths and the cutter taper. The longitudinal feed must be such as to allow for the change in the point of contact between the cutter and the bottom of the groove caused by the change in the spiral angle of the groove.

From this cut or a second or a third similar cut, it should be possible to decide whether or not the groove shape at the small end will be made to coincide with that of the already turned groove by slight endwise adjustment of the cutter with a corresponding change in the cutting depth. The cutter position having thus been determined, the blank should be reduced to its correct diameter, the groove re-turned to its proper depth and the milling operation repeated. It is unlikely that the small change in the diameter will materially affect the result.

If after the first finishing the groove is not as circular as is desirable at either end, a change might be effected by making the cutter either bellied or hollow lengthwise, the relation of the feeds being altered to allow for the diameter change.

NEW BOOKS

PRINCIPLES OF SELLING—*By H. K. Nixon, assistant professor in the School of Business, Columbia University. 330 pages, 8¼ x 6 in. Illustrated and indexed. Cloth board covers. Published by McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York, N. Y. Price, $2.50.*

Selling is a prime necessity of business. A good salesman is priceless. The object of this book is to help make good salesmen.

Intangible as the art of selling is, the author has discovered nine basic principles which apply in most sales. They form the foundation of his book. Tricks and the methods of the high-pressure school are beyond the pale of honest, successful selling. Understanding and consideration take their place in Mr. Nixon's program. The ramifications of both specialty and retail selling are covered. Examples sharpen the points and concise reviews conclude each chapter.

This is not only a book for salesmen; every man in industry should tuck away in his brain these principles upon which sales are made. They will prove helpful almost daily.

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A SCIENTIFIC APPROACH TO LABOR PROBLEMS—*By Adelbert Ford, professor of psychology, in Lehigh University. 446 pages. 6x9 in. Clothboard covers. Indexed, illustrated and diagrammed. Published by the McGraw-Hill Book Company, 330 West 42nd St., New York, N. Y. Price $4.00.*

This book follows the pattern of similar publications, but does so thoroughly and in simple language. The book is divided in two parts: the first presents facts in plain language; the second approaches the subject in terms of mathematical reasoning.

Since there has been little discovered about vocational fitness and classification since Munsterberg and the committees on classification of personnel that were organized during the war, this book, is largely the personal experiences of the author in using the discoveries and methods of his predecessors. It carries out the promise of its preface and has the merit of being thorough. An extensive bibliography and a detailed index are included.

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UNTERSUCHUNG ÜBER DEN SCHMIERVOGANG IN CLEITLAGERN (Investigation of the lubricating process in sleeve bearings)—*By Dr. Ing. W. Nucker. Forschungshaft 352 (Supplement to Forschung auf dem Gebiete des Ingenieurwesens), Vol. 3, January, 1932. In the German language. 84 pages. 9x12 in. 9 tables. Paper covers. Published by VDI-Verlag, G.M.B.H., Berlin, N.W.7 Germany. Price 5 marks (4.5 marks to VDI members).*

The trend in machine design toward heavier loads and higher speeds means greater stress on bearings. Though ball and roller bearings are commonly and successfully used, the sleeve bearing has so many attributes that it is still indispensable. It is impossible to judge the capacity of highly loaded sleeve bearings without a thorough knowledge of the lubricating process. This had led to a number of experiments, many of which have not been readily applicable because of the great variation in evaluation of results. This study, however, makes use of new testing equipment, using instruments capable of measuring friction, oil quantities, pressures, temperatures, and thickness of oil film. Studies were carried out on the limiting thickness of the carrying oil film, influence of bearing length, distribution of pressure, dislocation of shaft temperatures and local friction, total bearing friction and of shaft temperatures and local friction, total bearing friction and circulation. These results are made usable by evaluation with the hydro-dynamic theory, thus making the booklet one of the most important for designing engineers that has recently appeared.

A class in machine shop practice in a Stockholm apprentice school

Apprentice Training in Sweden

A. E. FRISTEDT
Stockholm, Sweden

If the skill and thoroughness of the Swedish mechanics in the United States are the result of apprentice training in their homeland, the training schools of Sweden described by the author are efficient

IN THE latter part of 1929 and the first half of 1930 it was almost impossible to find a first-class lathe hand or a good milling-machine operator in Sweden who wanted a job. Everybody was busy elsewhere. It is evident from this fact that the number of skilled mechanics trained each year was too small. Perhaps some executives will remark that the result of turning out enough mechanics for an unusually high production is the equivalent of creating an army of unemployed skilled operators who cannot find employment except when there is much work to do. But if these men were not trained in their respective lines they would be unemployed for much longer periods. Knowledge is not heavy to carry, and the expense connected with the practical training of young men is small compared to the sums of money expended every year for their theoretical training.

I have got into difficulties several times because I have not had enough skilled men and have often been forced to hire men I knew did not belong to the best class. But when a certain amount of work must be produced within a specified time, there is no other alternative.

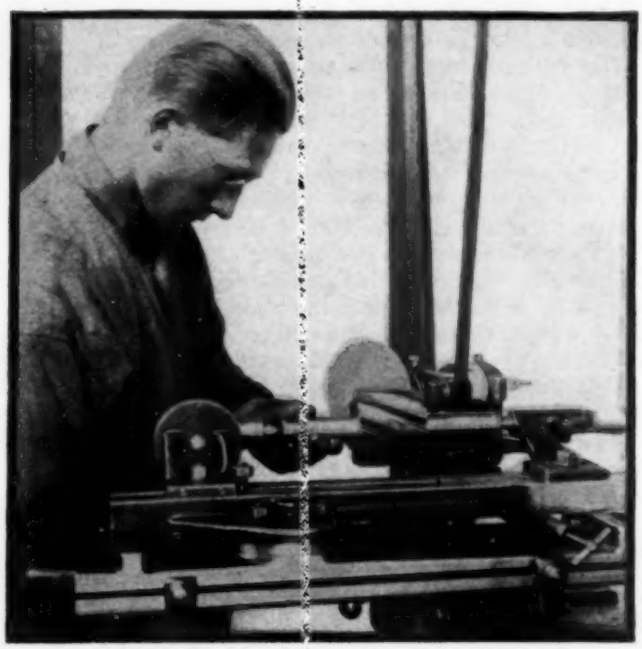
About 63,000 men are normally employed in the engineering industries in Sweden. About 1,000 of these die every year, some of them leave for other jobs, and the need of skilled help also increases as the industry develops. The demand for recruits is therefore about 2,000 per year. At the age of nineteen an unskilled young man receives such high wages that it is too expensive to train him at this age. The training therefore starts quite early. Rationalized methods must be applied to the practical training of young men. The old method of placing a boy at the side of a skilled mechanic whose duty it was to teach the boy is not considered efficient

any longer. The large engineering works have apprentice departments for training their own help, but many small shops throughout the country do not have any scheme at all by which boys are taught craftsmanship.

Realizing this, the Riksdag several years ago decided that trade schools should be built in those parts of the country where there was a sufficient demand for them. The largest and best equipped of these schools is at Stockholm, an interior view of which is shown. The machine shop is located on the second floor. On the first floor is the school for automobile service. The third floor is used by the electrical school and the fourth floor provides rooms for theoretical instruction. Connected with the machine shop, but in separate rooms, are the blacksmith shop, hardening room, etc. The work at the school is carried on from 8 a.m. until 10 p.m., including day and night schools. The courses offered cover practically every phase of the mechanical field. The teaching at the school is carried on under conditions similar to those met in practical life. Working efficiency is well maintained, so that the boys, from the beginning, get the right ideas of modern production. Discipline is upheld just as in a regular machine shop. If an apprentice does a poor job or if he reports too late, he is given one or two warnings. Should he repeat the mistakes he is discharged from the school.

The working methods used are those found in any toolroom or in machine shops with a mixed production. A tool crib is included in the shop. There the boys may borrow all the tools necessary for a given job. Every damaged tool is charged to the boy responsible, and if the damage is the result of carelessness he must pay for it.

The boy's work begins with plates in which he drills holes, mills slots, machines angles, etc. The purpose of this is to give him experience on machine work. After this primary work he passes on to simple details which must be finished in a given time. Later come more complicated machine parts and small tools, and finally complete machines. These machines are sold in the open market, and the money received is distributed among the boys. Besides this, development work is done, and machines for special purposes are made at a low price. The automobile school repairs automobiles of all kinds. This money is also divided among the apprentices.



Practical shop conditions and practices are closely followed in all particulars

The day school offers complete courses in the mechanical trades, but in the night school special courses are conducted. Their purpose is to give those already engaged in the mechanical industry a better knowledge of their work.

Alternating with the practical work, the boys study theoretical subjects such as arithmetic, drawing, physics, heat-treatment of steel, etc.

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Milling Cutters—*Discussion*

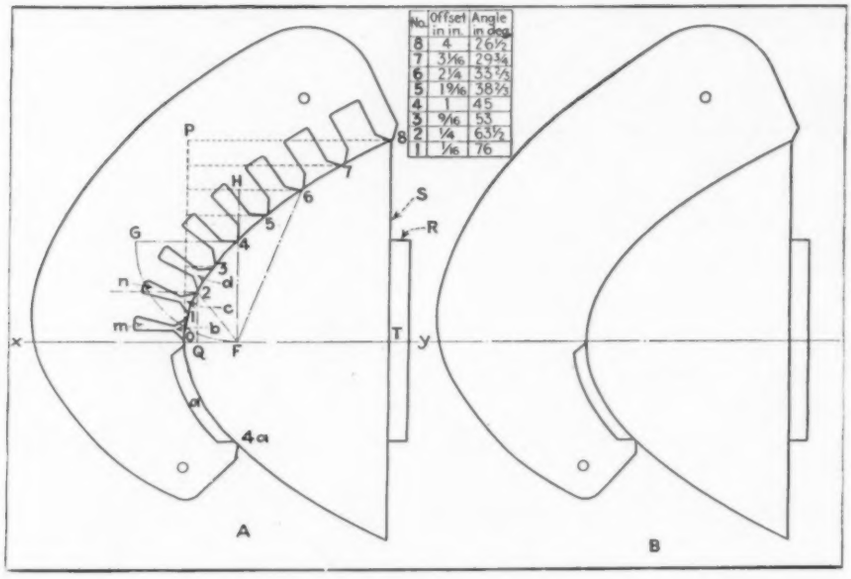
D. C. WRIGHT
Works Manager,
Graver Tank and Manufacturing Corporation

THE brief account published (*AM*—Vol. 76, page 182 on the use of rough cast iron milling cutters in satisfactorily machining certain metals attracted my interest. Some twelve years or more ago, the writer had occasion to supervise a large contract for a specially shaped belt pulley, requiring accurately radiused crown and flange surfaces.

These specifications in themselves would not have been particularly difficult to attain had the purchaser not further stipulated that the castings were to be made with an absolute minimum of finish in order to secure the benefits of the surface chill in his finished product. Since no modern grinding equipment was available, and the more recent additions to the list of cutting alloys were at that time still undiscovered, we had a merry time of it with various combinations of hardened tool steels, none of which "stood up" long enough to permit of a single complete cut without regrinding.

In desperation and more as a stunt than anything else, I had one of the lathe men try a piece of hard cast iron, broken from a common rectangular "gagger" section, which had been poured from the brittle, almost glass-hard, iron commonly known as "stove plate." This crude tool with a minimum of dressing, much to the surprise of both of us, stood up fully as well as the tool steel bits had done. So, emboldened by this rough test, we had a "board" of ½ in. square strips made up, which the foundry foreman merely molded in a rough sand bed and poured from the ladle bottoms on the side floor.

These strips or sticks, some 18 in. long, were broken up into bit sections approximately four inches in length, which were just right for mounting in a common Armstrong type toolpost holder. These bits were supplied to the lathe men by the box full, and no time was wasted in dressing them, a fresh one being inserted whenever its predecessor proved too dull. Actually, in practice it became possible to average a complete traverse across the face of the pulley before the necessity arose for changing tools, so that it became the habit to make a shift at that time automatically, without waiting for trouble. With the lower initial cost of the tools and the elimination of grinding, the method proved a real money maker.



An accurate contour is obtained after heat-treatment by using two special gages and computing the settings for a universal grinder

WALTER WELLS
Die and Jig Designer,
Metropolitan Engineering Company

Grinding a Reflector Punch

THIS METHOD of finishing punches that have a parabolic axial cross-section is offered as an improvement over the usual way of finishing up the piece on a lathe and trusting to luck that it will retain its form in hardening. In a certain shop this method was evolved through necessity. A punch upon which a great deal of labor had been expended bulged during heat-treatment, so it was decided to grind it somehow to fit the templet again.

Beginning with a vague idea of "doctoring" the punch a little at a time on the universal grinding machine, a methodical procedure was finally evolved to make the various settings and cuts rapidly and without guesswork. Two similar punches were subsequently ground in this way with a considerable saving of time because it was merely necessary to rough turn them before hardening.

The drawing shows the punch in two stages of completion. At *A*, the outline consists of a series of nine tangents to a true parabolic curve. At *B*, we see this true curve on the finished job. A pair of templets, identical in gaging outline but otherwise designed for their separate purposes, are also included. It is well to remember that while these side views show the parabolic curve, an end view (or a radial cross-section) would show a circle. Since this is understood, it need not be illustrated.

The universal grinding machine is prepared by cleaning and oiling the swivel headstock so that it may be swung freely to any required angle when the clamp screw is released. An S-wrench to fit the clamp nut is laid conveniently by.

The roughed-out punch is then firmly caught in the chuck and trued up on the shoulder at *S* and *R* with an indicator. A free-cutting wheel of convenient diameter is secured to the spindle in the usual way, the table is swung around to a grinding position, and the centers are raised to coincide with the wheel center. The head is then brought to 90 deg. and clamped. The first flat at the apex *0* of the curve may now be ground. This flat should be not less than $\frac{3}{4}$ in. wide because the succeeding flats must have sufficient stock to clean up.

The templets, of course, have to be filed up at the start so that one of them may be used during the turning. Incidental to their laying out, the proper angle of each of the other flats must be figured out by the use of practical trigonometry. The layout of the parabola is made, by using the well-known offset method. The offsets vary as the square of the distance along the axis *x-y*. The hypothetical rectangle inclosing half of the parabola *P8T0* is 4x4 in. This area is divided into eight horizontal sections, each $\frac{1}{2}$ in. wide, the lines crossing the curve at *1, 2, 3 . . . . . 8*. At these intersection points, the various tangent cuts are made.

To find the tangent angle at any of these intersections, we must proceed as follows: Taking for example Point No. *4* (this is at the halfway point), $\frac{1}{2} \times \frac{1}{2} \times 4 = 1$ in., the offset distance; that is, the fractional space, squared, times the dimension *P8*. We know that the tangent to any point on a parabola can be found by halving the angle formed by a line joining this point with the focus and a line parallel to the axis. (See angle *F4G*). Since this is 90 deg., and the focus *F* is 1 in. from the apex *0*, the same length as the offset at *4*, we get 45 deg. for the tangent at this point.

Take Point No. *6*. This is three-quarters of the height. Therefore: $\frac{3}{4} \times \frac{3}{4} \times 4 = 2\frac{1}{4}$ in., the offset. We have to construct a triangle *6HF* here based upon known distances. The known sides are *FH* and *H6*, the latter being the offset minus 1 in. (since *FH* and *0P are parallel*).

Then tan angle $H6F = 3 \div (2\frac{1}{4} - 1) = 2.4$. Angle *H6F* equals $67\frac{1}{3}$ deg. and the angle of the tangent to the parabola is half this or $33\frac{2}{3}$ deg.

For Point No. *2*: $\frac{1}{4} \times \frac{1}{4} \times 4 = \frac{1}{4}$ in. The triangle here is *2QF*, and since *2Q*, is parallel to *0P*, two sides are known. Tan angle $Q2F = (1 - 0.25) \div 1 = 0.75$, or the tangent of 37 deg. (approximately). Adding

90 deg. to obtain the angle sought, we get 127 deg. Halving this gives 63½ deg. for the set-up at this point. The other five points are similarly computed. The division need not be carried to more than three places. All of the eight calculations, at the rate of 2 to 3 minutes to each, should not take more than 20 minutes. This time is profitably spent when considering the job as a whole.

The grinding, of course, proceeds continuously, the matters previously referred to having been attended to during the interval that the punch was heating in the furnace. Attention is next brought to the 45-deg. tangent cut at Point No. *4*. The headstock having been swung to this angle and clamped, the traverse of the machine table will cause the wheel to cut a flat at just the proper point on the punch. To reach the proper depth, the special relieved templet must be employed. The three points, *0*, *4*, and *8* comprise the base from which to work, the remaining tongues along the gaging outline being bent back about 10 deg. to afford clearance.

This templet, in itself, is interesting as a similar design could be employed on other work to advantage. It was made of $\frac{3}{64}$ in. gage stock and finished in one filing with the templet at *B*. In this respect, it took little time. The reliefs are made with an ordinary hand saw. The tongues are made reasonably parallel and tangent to the curve to obviate a twisting distortion when they are given the bend mentioned above. They are about 1 in. long by ½ in. wide. The other reliefs, *a*, *b*, *c*, etc., are an obvious convenience. Only $\frac{1}{32}$ in. flats are left at the gaging points *0*, *1*, *2* . . . *8*.

As fast as the other tangents are ground, the corresponding gaging tongues are rebent to a plane with the templet and utilized to get the proper depth. The grinding and successive reclamping should go along quite rapidly.

The contour of the punch will soon appear like the left view, a series of flats. The next step is to wipe a coating of coppering solution over the face of the punch. The trick then is to set the headstock rapidly through a new series of angles and grind the "peaks" at the juncture of the first set of tangents. We split the difference between the first series of angles. The secondary flats should be about half the width of the neighboring primary flats, measuring with a scale. The depth of cut is also a convenient check. It should be not more than $\frac{1}{64}$ in., averaging 0.014 in. This completed, the surface will appear surprisingly smooth and the flats can be barely noticed by running the hand over them. None of the peaks are more than 0.004 in. high now, and they could be cut down to half of that by the vigorous use of coarse emery cloth.

With only a 0.002-in. deviation from a true parabolic curve, the job might well be called good enough. But if an extra fine job is insisted upon a third series of 16 flats may be ground off in the same manner as with the second series. Since the accuracy increases in inverse squares, little is left for the emery cloth to take off. The second templet is used as a final check. The punch finishes perfectly in every respect. The time saved is obvious.

It might be well to suggest that other curved pieces, either elliptical or circular, might lend themselves to this method of finishing where there are only a few pieces to be made and no special curve-grinding attachments. The various offsets and angles could be figured out just as readily.

Practical Considerations in Gear Selection

Discussion

J. W. BAUGHER, JR.
Westinghouse Electric & Manufacturing Company, Nuttall Works

THE QUESTION of the maximum ratio of reduction that is allowable with a single pair of gears is one that arises frequently. As pointed out (*AM*—Vol. 76, page 197), space is an important factor—in fact, it is often the most important for parallel-shaft gearing.

Many books on gears say that good practice limits the minimum number of teeth in a pinion to 12 or 14; consequently, the author's recommendation of a 9-tooth pinion probably needs some qualification. Generating methods of cutting gears result in "undercutting" of the teeth when the number of teeth is small and the tooth form is made according to one of the standard systems, such as the American Gear Manufacturers Association 14½-deg. full-depth, 20-deg. full-depth, and 20-deg. stub systems. For these three systems, the minimum number of teeth that can be generated without undercutting is 31, 17, and 14, respectively. If the teeth are cut by the milling, or rotary-cutting, process, the minimum number of teeth possible without undercutting is 12, because the A.G.M.A. 14½-deg. and 20-deg. composite systems (formerly known as the Brown and Sharpe systems) are based on a 12-tooth pinion as the minimum. When a gear tooth is undercut, a portion of the lower section, or flank, of the tooth is cut below the theoretical involute shape. The contact may be shortened until the teeth of the pinion lose contact entirely with the mating teeth during each engagement and come together again with an impact.

Another evil of undercutting is the reduction in strength of the teeth. Why then should the author recommend a 9-tooth pinion? The answer lies in the use of a long-and-short-addendum system rather than one of the standard systems. With such a tooth form, a 9-tooth pinion can be produced with no undercutting whatever.

In his discussion of the type of tooth—spur, single helical, or herringbone—to employ for parallel-shaft gearing, the author mentions the restrictions imposed by speed and noise. Since the limits depend to the greatest extent on the accuracy with which the teeth are cut, numerical values can serve only as a general guide and really indicate the approximate speeds at which the gear noise may become objectionable when operating under the conditions of mounting and lubrication usually existing in open-gear installations.

The commercial grade of spur gearing with teeth cut by the milling process is satisfactory for operation up to pitch-line speeds of about 1,200 ft. per minute. Commercially-cut spur gears produced by one of the generating processes may be used up to velocities in the neighborhood of 1,800 ft. per minute. Generated single-helical and herringhouse gears may be run at speeds of 2,200 ft. per min. and sometimes greater. For pitch-line velocities above this figure the open type of gearing usually is not suitable. If the gears are heat-treated after the teeth are cut, these limits should be reduced about 20 or 30 per cent.

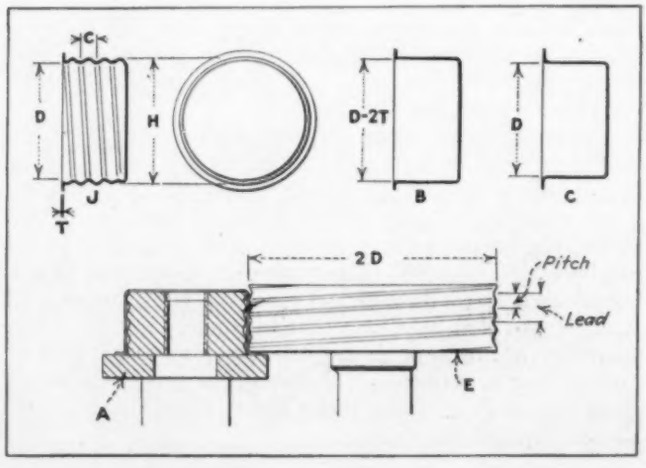
IDEAS FROM PRACTICAL MEN

A Thread-Rolling Attachment *Discussion*

JAMES R. CORNELIUS
Machine Designer
Coventry, England

I WAS much surprised at the article by Henry W. Boehly under the title above (*AM*—Vol. 75, page 674). While I admit that Mr. Boehly's idea is all right, I cannot accept the article as a sound basis to work upon. If the sketch given is any criterion to the actual dimensions of the articles to be threaded and the tools employed, then I am positively certain that the shell was never threaded with any degree of accuracy, and that no two shells would be alike.

In attempting to roll a thread on a thin shell, such as a cap for a container, in tinned iron plate, or a stopper for a Thermos flask, there are several points that must be considered and abided by. First, the mandrel *A*, which may be considered as a rotating die, must approximate as closely as possible the inside dimensions of the drawn cap before threading. Thus, if we take a drawn shell, we can have two dimensions, as at *B* and *C* in the illustration. The inner diameter of *B* is approximately twice the thickness of the metal less than the diameter *D* over the thread of the finished cap, while the inner diameter of *C* is approximately equal to the inner diameter at the root of the threads in the finished cap. The more accurate cap will be made from the shell *B*.



Mandrel *A* will fit into one or the other of the shells.

With shell *B*, the thread is impressed into it and when the operation has been finished the mandrel must be stopped and the shell unscrewed, or else special differential gearing must be employed to remove the shell while the machine continues in motion. With shell *C*, the thread is raised upon it, there being generally a plain portion left at the end to retain the smaller diameter as a base.

Owing to the increase in diameter of the shell, it is obvious that for each rotation of the mandrel there will not be a complete rotation of the shell *C*, since the periphery of the shell will exceed that of the mandrel. This will cause a lag in the number of revolutions of the shell, which will naturally increase in proportion to the discrepancy in the two diameters. This lag causes the thread to be formed and then flattened out, again to be formed and flattened out over a certain portion of its length for each revolution of the mandrel. This continual working causes the metal to expand and accounts for the longer time that is required to obtain a rolled thread when using slack mandrels and small shells.

In comparison and example, I will show what is implied here. A mistake was made in the diameter of a cap for the stopper of an aluminum hot-water bottle. Since the deficit was nearly 0.045 in., and since several thousand had been stamped and drawn, it was considered advisable to utilize them and to thread-roll them on a slack mandrel. The time taken to expand them allowed for an output of 46 per min. The tools were altered and the correct size of shells were produced, which when rolled on an accurate mandrel gave an output of 115 shells per minute.

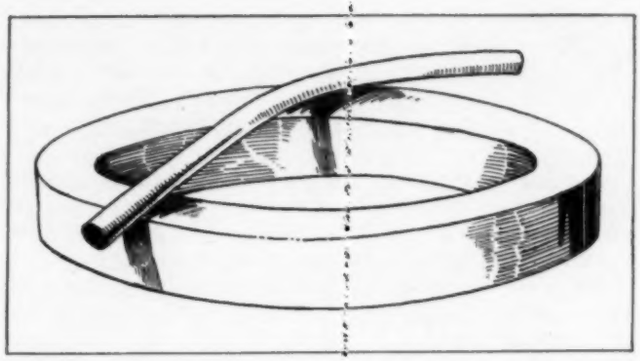
Just one more point that is perhaps the most important of all: Mr. Boehly shows a mandrel that is considerably smaller than the shell working in conjunction with a roller considerably larger, yet makes no mention as to whether or not there should be any definite relation between the two diameters. Actually, the roller *E* should be accurately calculated for diameter to produce a single or a multiple thread having the same helix angle as is required on the outside diameter of the cap. This means that the diameter of the roller must be a multiple of the mean diameter *H* of the shell *J*, and that the thread on the roller must have the same number of starts as its diameter is a multiple of the diameter *H* of the shell. To attempt to roll threads without consideration for this rule will end badly for the component to be produced.

Summing it up, it can be said that the mandrel *A* should be a correct reproduction of the interior of the threaded shell *J*, and that the roller should be a correct reproduction of the exterior of the shell, or a multiple of this, to obtain the best results. Where possible, both the mandrel and the roller should be so geared together that their speed ratios are in inverse proportion to their correct ratios to avoid slip-threading and bruising, caused by male threads contacting with one another.

A Ring-Anvil for Straightening Work

GEORGE A. LUERS

In straightening shafts, axles, bars and rods, the usual practice is to support them in V-blocks mounted on a flat plate. However, one plant utilizes a heavy forged and rough-machined ring instead of the usual



V-blocks. The work to be straightened is laid across the ring with the bend upward, as indicated in the illustration, and is moved into the most favorable position for straightening.

Rolling the work nearer the edge of the ring brings the supporting parts nearer together. Thus the distance can be varied to suit either long or short bends. For testing the straightness of the work, it is rolled across the ring. If it is straight it will roll evenly and smoothly. Of course, if the work is to be straightened accurately, it must be marked while revolving between centers, or supported on rollers, and tested by an indicator after each attempt at straightening.

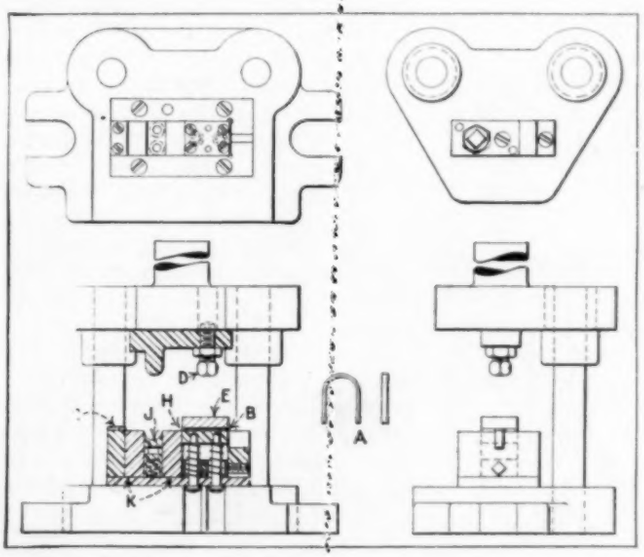
Press Tools for Making Staples

CLARENCE G. HOLLAND

The tools illustrated are for producing staples, such as the one shown at *A*, from 0.104x0.023-in. stainless-steel wire. The die is made in sections that are confined in a nest, as shown in plan in the upper left-hand corner of the illustration.

In operation, the stock is pushed through the work guide *B* and against the stop block *C*. As the ram descends, the head of the setscrew *D* strikes the movable cutter *E* and cuts off the blank against the stationary cutter *H* just as the forming punch contacts with it. As the ram continues its descent, the movable cutter is forced into a pocket in the nest, and the forming punch carries the blank down against the form *J*. Since the form is backed by stiff springs, it is carried down between the spacing blocks *K*, thus forming a staple.

As the ram ascends, the staple is ejected by the rising of the form through the pressure of the springs.

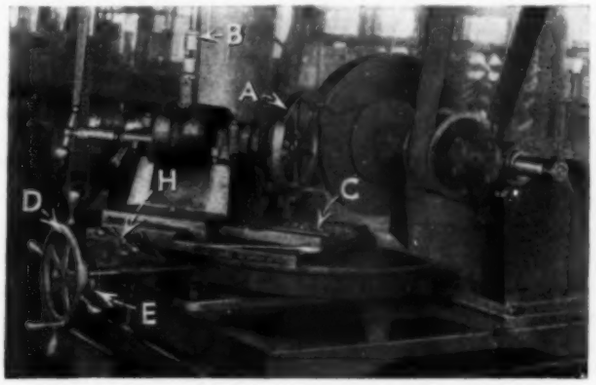


Grinding the Rims of Handwheels

A. E. GRANVILLE

Owing to the hard surface of cast-iron handwheels, some shops prefer to finish the rims by grinding instead of turning. Where many such wheels are to be finished, some form of special grinder is desirable. One shop grinds the rims of its handwheels on the machine illustrated. This machine was made from parts regularly used in the manufacture of other machines sold by the concern.

The grinding head is solid to stand high speed and



will not whip nor chatter when properly adjusted. The spindle carrying the handwheel *A* is slowly revolved as the wheel is ground by the vertical shaft *B*, which has universal joints, through bevel gears from an overhead countershaft. The work-spindle head is mounted on a rotating table centered at *C*. This table is rotated by hand by means of the pilot wheel *D* through worm gearing. The entire table mechanism can be fed in or out by turning the handwheel *E*, which is almost hidden behind the pilot wheel. Adjustment of the work head to or from the grinding wheel is made by turning the ball crank *H* at the front of the machine.

Truck for Handling Heavy Chucks

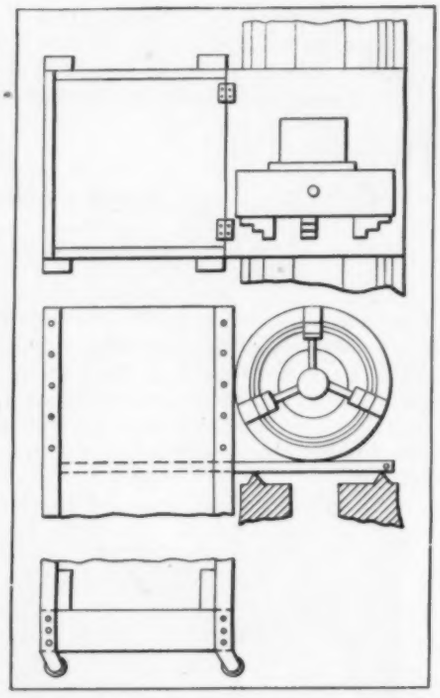
HARRY MOORE

Hamilton, Ontario, Canada

Lifting a heavy chuck on and off of a lathe is usually a two-man job, but if one man can manage it, he certainly dislikes the job, especially if the chuck is to be handled from the floor to the lathe, or vice versa. A way to eliminate all this heavy labor is to keep the chuck at all times at the same level as that of the lathe bed. I suggested this to the proprietor of a small shop and the result was the hinged box or truck mounted on casters, as shown in the illustration.

The box was secured from the woodpile, one side was taken off, and part of it was hinged. Then four legs were nailed on securely, the height of the legs being such as to bring the hinged part of the side level with the

lathe bed when it was opened out flat. In addition, a shelf was put in the box at the height of the hinges.



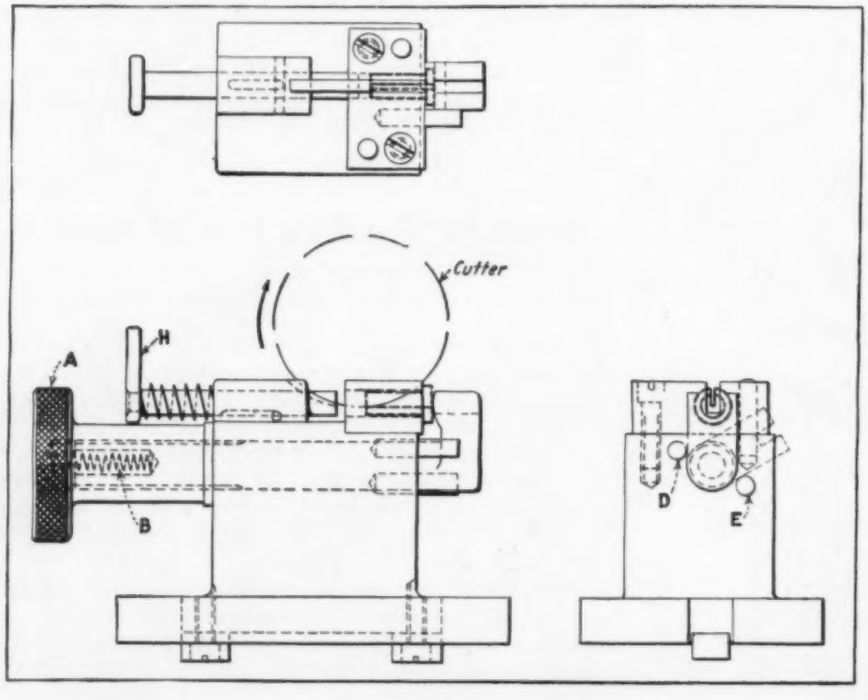
With this arrangement, one man could handle a heavy chuck with little effort. When taking off or putting on the chuck, the box is rolled up to the lathe, and the hinged part of the side is laid flat on the bed. If the chuck is to be placed on the spindle, it is rolled out of the box on the hinged portion. If the chuck is being removed from the spindle, it is unscrewed on the hinged portion of the box and is rolled inside. Then the hinged portion is closed and latched, and the whole thing is rolled against the wall, out of the way.

Fixture With a Quick Acting Clamp

C. COLE

In the illustration is shown a fixture having a quick acting clamp for holding the work. After the work has been loaded in the fixture, it is necessary only to turn the knurled nut *A* to the right to clamp it. The spring *B* causes enough friction between the nut and the threaded part of the clamp, so the head *C* of the clamp is brought against the stop pin *D* and opposite the end of the work. Further turning of the nut in the same direction draws the head of the clamp against the work, holding it securely.

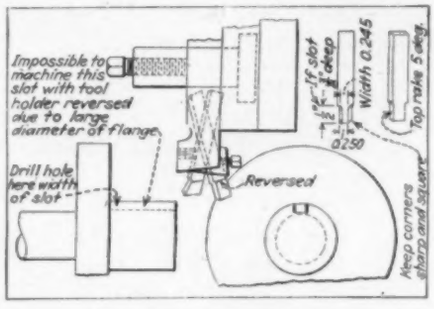
Turning the nut to the left pushes the clamp head away from the work, and further turning in the same direction turns the clamp head against the stop pin *E*, as indicated by the dotted lines in the end view at the right. This permits the use of the ejector *H* to knock out the work from its seat. The fixture is then ready to be loaded with another piece.



Cutting Slots in the Shaper—*Discussion*

ARTHUR SILVESTER
Sales Manager, The Iten Fibre Company

In an article under the title given above (*AM*—Vol. 75, page 642), Theodore Kruger says he has often noticed that workmen have trouble in cutting slots and keyways in the shaper, because of chattering and other causes, resulting in tool breakage and sometimes in injury to the workman. He suggests reversing the usual setting of the toolholder as a remedy, but does not offer any solution or suggestion that will help the mechanic to do the job by setting the toolholder in the correct way.


Impossible to machine this slot with tool holder reversed due to large diameter of flange
Drill hole here width of slot
Reversed
Width 0.245
0.250
Keep corners sharp and square
Top rake 5 deg.

The mechanic who looks to the *American Machinist* for solution of the various problems that crop up in his daily work, wants to know what causes the trouble when he finds difficulty in doing a piece of work; in this case, cutting a keyway or a slot in the shaper in the usual way.

While it is possible that the method outlined by Mr. Kruger can be used, obviously it is not the right way of doing the job. I venture to say that the man who is cutting a keyway with the tool set in the usual way will also have trouble if he adopts Mr. Kruger's method. There are lots of jobs where his method could not be used. For instance, there are jobs in which the tool could not reach the end of the cut, owing to interference of some part of the work, as in the accompanying illustration.

Nearly all the trouble that is met with by the machinist or tool maker in the class of work in question is because he has to do it but a few times in a year. If the job were given to a regular shaper or slotter hand, he would get it done quickly

and do a good job, as he knows by experience what will cause his tool to give trouble and what to do to remedy it.

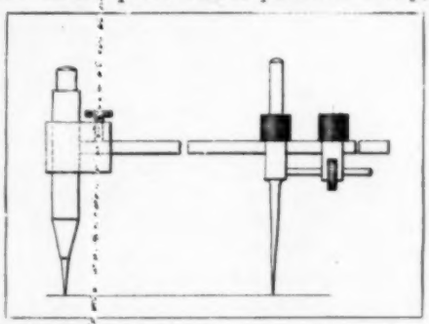
The causes of trouble are: (1) Taking too heavy a cut, 0.002 or 0.003 in. is ample; (2) Too much clearance or top rake, or not setting the tool correctly; (3) Either the tool is set too far out from the holder or the blade is too long and weak, resulting in pushing out the metal instead of cutting cleanly; (4) Play caused by wear in the toolbox slide. The remedies are simple and obvious. If the above causes of trouble are eliminated, the job is comparatively simple.

If slots or keyways $\frac{3}{8}$ in. or over in width are being cut, and the work is being done in a small shaper, I believe it is wise to rough out the slot or keyway with a tool $\frac{1}{4}$ in. wide and then finish with a tool ground to the width required. The result will be a clean-cut job. In regard to using the toolholder in reverse for trepanning in the lathe, it has been found of great advantage and has been adopted in many shops with a consequent saving in time.

Automatic Center Punch Used on a Tram

JOHN AYRES

Circular layout work can be greatly facilitated and the lines can be more accurately prick punched by using an automatic center punch on the tram beam in place of the stationary point. If the point of the punch is sharp, the scribing and the prick punching can be done with this combination at one setting. I made an adapter for holding the center punch on the tram beam out of a piece of suitable size, and drilled and tapped it for the holding screws. The illustration shows the scheme. Diemakers will find this device useful in laying out holes for drilling out the center pieces of large dies, especially if a spacing attachment is used on the punch.



SEEN AND HEARD

JOHN R. GODFREY

Pocket Precision Scale

Way back in 1885, Darling, Brown & Sharpe announced in *American Machinist* an important improvement in their graduated scales, which permitted, according to the advertisements, dividers to be set to thousandths of an inch. The end of the rule included a scale of hundredths, nine spaces of 0.011 in. each, and a diagonal line of dots, the point nearest the edge of the rule being 0.012 in. from the last line, the second point 0.013 in., and so on. Thus each dot was 0.001 in. further from the line than the point preceding it. By the addition of the nine 0.011 spaces, measurements could be made and dividers set by thousandths of an inch, from one-tenth of an inch to any length on the scale of hundredths; and with the addition of the nine 0.011 spaces and line of points, dividers could be set by thousandths, from 0.01 in. to any part of the scale. Concluded the ad, "Believing this device to be of great convenience, and much needed in the present advanced state of the mechanic arts, we have added it to all lengths of our scales without extra charge."

The Urge for Speed

We saw something new in the way of tapping speed when Haskins demonstrated a new high-speed tapper on typical parts sent in by Chicago manufacturers. In one set-up, a No. 6-32 tap operating at 4,000 r.p.m. was threading blind holes $\frac{5}{16}$ in. deep in a zinc die casting. On the same piece a No. 10-24 tap, operating at 3,000 r.p.m., was threading through holes. On a cold-rolled steel piece, a No. 8-32 tap, operating at 3,000 r.p.m., was threading three through holes at the rate of 700 pieces, or 2,100 holes, per hour. On another set-up, one through hole was being threaded in an aluminum die casting at the rate of 1,650 pieces per hour, using a No. 8-32 tap operating at 3,600 r.p.m. In cast iron, a No. 10-24 tap was being operated at 2,600 r.p.m. In another aluminum die casting 3,350 blind holes, 12 to the piece, were tapped per hour with a No. 8-32 tap operating at 3,000 r.p.m.

Copper-Plated Insects

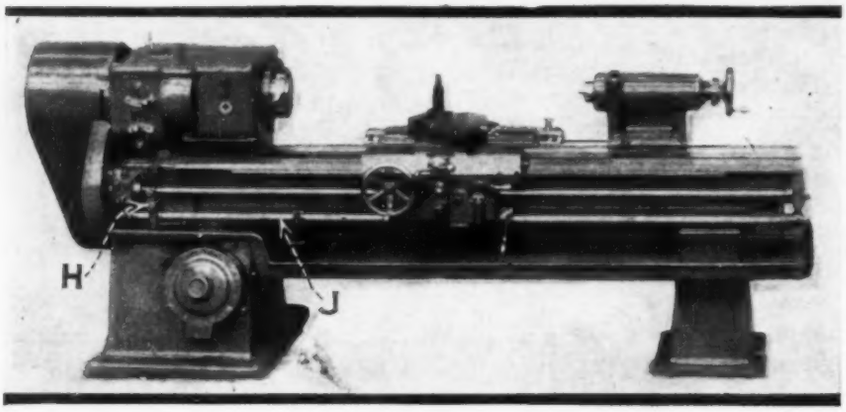
Dr. N. D. Zeinsky, a German chemist, successfully plates insects with copper to preserve all their delicate markings and structures. This process was discovered while making chemical analyses of certain insects. The procedure involves covering the bugs with a copper compound, then heating them in small platinum crucibles in an atmosphere of carbon dioxide. A specimen thus prepared may be kept indefinitely.

Red Lines and Safety Shields

We have become accustomed to aisle lines on shop floors and they surely help as reminders to keep things where they belong. A new version of this cropped up recently when a newly painted red line batted me in the eye, in contrast to the white lines in other parts of the shop. This was the dead line for smokers, as it surrounded a department where dopes and ingredients of an inflammable nature are used. Smoking is not permitted during working hours in any part of the shop, but at other times it is permissible outside of the danger zone. This red line is kept freshly painted so that no one has the excuse of not knowing where it was.

The same shop had another psychological device in the shape of a substantial shield behind the balancing machine. Although there had never been an accident from the rotors being tested flying out of the machine, every worker in line with it worked with one eye on the balancer. Putting in this shield, which is also kept painted so that everyone sees it, increased the work in this vicinity about ten per cent.

SHOP EQUIPMENT NEWS



LeBlond High-Speed T. C. Production Lathe

A PRODUCTION lathe developed especially for use with cemented carbide tools, and differing in many respects from the usual production lathe, has been announced by The R. K. LeBlond Machine Tool Co., Cincinnati, Ohio. This machine has a Timkenized helical-geared head, and is driven by a 25-hp. variable-speed motor. Spindle speeds range from 150 to 2,400 r.p.m., the range from 150 to 600 r.p.m. being obtained through backgears, and the range from 600 to 2,400 r.p.m. by means of direct drive to the spindle. A six-sheave V-belt drive is employed.

The driving pulley is supported between two Timken bearings, Fig. 2, one in an outboard bearing and the other in the headstock. The outboard bearing is mounted in a heavy bracket to insure alignment of the pulley under severe operating conditions. When the spindle is driven direct from the motor, the gear *A*, Fig. 3, is shifted to the right and acts as a splined coupling between the drive shaft and the spindle *B*. This construction prevents the driving pulley load from coming directly on the spindle, and thus causing vibration and wear. When the gear is in the direct drive position, the flanges *C* and *D* are in line, and these make it impossible to engage the backgears. To use the backgear train, the gear *A* is shifted to the position shown, and the backgears are meshed by means of the lever *E*, Fig. 2. All gear faces are wide.

The large spindle is mounted between two Timken bearings, *F* and *G*, Fig. 2. The spindle is shorter than usual to eliminate tendency toward deflection under severe operating conditions. All of the headstock bearings are supplied with forced-feed lubrication, the oil being pumped from the reservoir located in the bed. An oil filter is placed in the line from the pump to the bearings.

All feed gears in the headstock are mounted on Timken bearings. Nine feed changes are available, ranging from 0.002 to 0.025 in. per revolution. The feed rod is mounted on two Timken bearings at the headstock end, and on a straight roller bearing at the opposite end. The automatic length stop *H*, Fig. 1, consists of a positive clutch, which is disengaged by a boss on the apron that engages an adjustable trip dog *J* on the controller rod.

A heavy semi-steel casting is employed for the bed, and it is equipped with hardened and ground Nitralloy front and rear ways that are attached securely to the bed. This feature is especially desirable for a production lathe, as it prevents local wear on the sections of the bed most used.

The apron is of extra heavy box-type construction and equipped with an oil pump that automatically lubricates the ways, cross-slide and cross-feed screw bearings. The first stud and rack stud are mounted on ball bearings to eliminate friction loss at these points.

Improved Taper Attachment

The taper attachment is of improved design, the guide bar being reinforced by a heavy rib. Accurate alignment of the guide bar shoe is obtained by locating the bar near the center of the crossfeed screw and supporting it by the carriage shoe *K*, which is in turn carried between two bearings. The telescopic feed screw is connected to one end of the carriage shoe. Two ball thrust bearings are used for this connection, and hence there is no backlash at this point. Two drawbars, *L*, are connected to the carriage shoe and extend under the cross-slide to a clamp located just in front of the com-

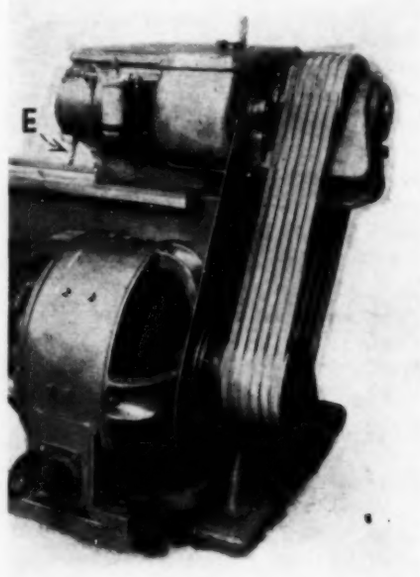
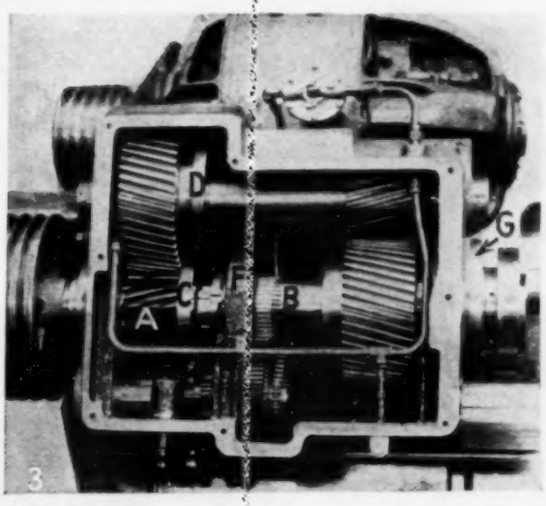


Fig. 2—Timken bearings, one in the outboard support and the other in the headstock, support the driving pulley, and a heavy bracket assures alignment



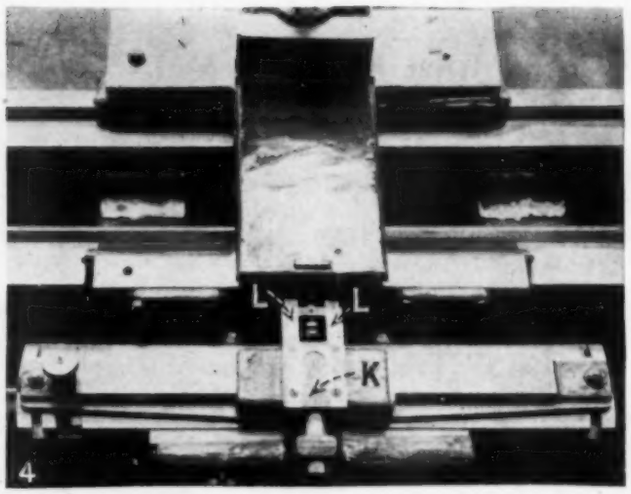


Fig. 3—Gear *A* is shifted to right for direct drive, and to the left for backgeared drive. Driving pulley load does not come directly on the spindle. Fig. 4—Improved taper turning attachment. The cross feed screw adjusts the depth for more than one cut. The draw bars *L* are clamped for precision finish

pound rest. When turning tapers, particularly when more than one cut is desired, this construction makes it possible to use the cross-feed screw to adjust the depth of cut. If a precision finish is not desired, it is unnecessary to use the drawbars. However, if extreme accuracy is required, the operator merely clamps the drawbars by means of the nut for the finish cut.

The extra wide square-type compound rest is constructed so that it has a large bearing when swiveled to any position. It is securely clamped to the cross-slide by four bolts. The carriage cross-slide is equipped with hardened slides.

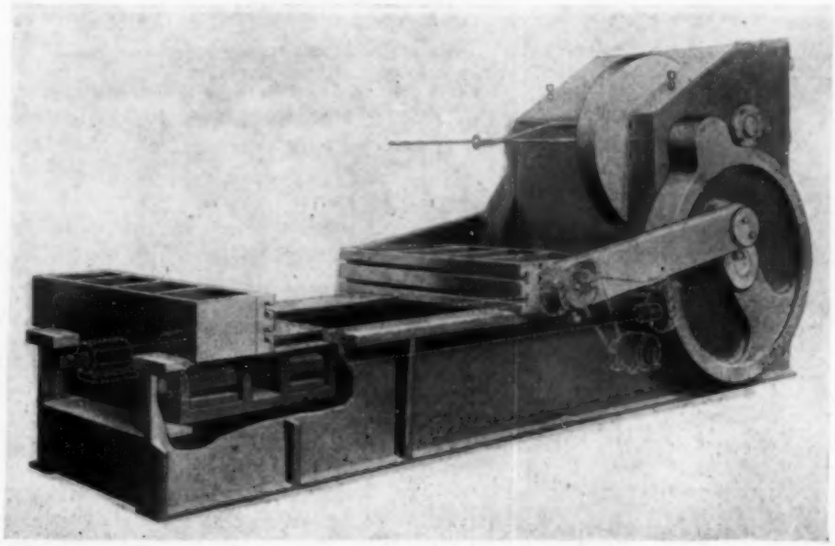
The tailstock is of special construction, having a hardened and ground spindle sliding in a hardened sleeve, which is pressed into the extra heavy casting. This prevents wear and insures accuracy for the life of the machine. Since it is impractical to use the usual type of clamp, a special design is used to locate the spindle in position. This consists of a ratchet mounted on a screw bushing, and a pawl in the ratchet. This makes it impossible for the spindle screw to back off and allow the center to loosen. However, a trip dog on the handwheel releases the pawl when it is necessary to withdraw the spindle.

"Steelweld" Bulldozer with Power Adjusted Dieholder

A line of bulldozers and bending machines, in which the outstanding element is a power adjusted dieholder, has been announced by The Steelweld Machinery Co., E. 70th and Machinery Ave., Cleveland, Ohio. The company has been building bulldozers of all-steel construction for some time, but it has been found that in a great majority of applications the time of changing and setting-up dies is a more important element of cost than the actual bending of the work. Very often work that could be bent in two or three blows, took half a day to set up. By the arrangement illustrated, the dieholder moves and therefore the usual search for packing and the time lost in setting-up is eliminated. A push button operates the machine. The long tie-rods run through to the operating head of the machine to minimize breakage of the tools, as the motor will stall before the danger point is reached.

Maximum power of the bulldozer is developed at the point where the crankpins go over center. In a job shop, it is frequently necessary to make heavy bends of a depth requiring more power than can be developed on the available machine with one stroke. With the moving end on the bulldozer, it is possible to make such bends with a comparatively light machine by using two or three strokes and by moving the dies up after each stroke.

This bulldozer has an all-steel frame in which the gearing is inclosed, but the main slides are of hardened and ground steel. Gibs are located underneath the ram so as to be out of the way of dirt and scale. Both the gearing and crank arms are of rolled steel. Crank and ram pins are of heat-treated special steel. Anti-friction bearings support the flywheel and high-speed shaft. Reversing twin disk clutches are used.



Cincinnati Keyway Milling Machine

Keyways and shafts from 1 to 18 in. in diameter can be milled with a keyway milling machine now being offered by The Cincinnati Milling Machine Co., Cincinnati, Ohio. This machine is built up from standard basic and semi-standard "Hydromatic" units. The straight section of the keyway is milled by a slotting cutter, and at the same setting the ends are rounded out by an end mill in a vertical spindle.

All controls including that for table, spindle, infinite feed (hydraulic) changes within the range, and rail assembly movements have been centralized at the normal operating position. Directional control levers assure accurate control. The slotting cutter is raised out of the cut by power, aided by a hydraulic counterweight. A 10-hp motor is furnished for the horizontal cutter and a 5-hp. motor for the vertical milling cutter. Any table feed up to 40 in. per min. is available. Twelve speeds ranging from 90 to 810 r.p.m. are available for the vertical spindle, and from 20 to 150 r.p.m. for the horizontal spindle. Higher speeds can be provided if desired. Both spindles have national standard taper holes.

Drive for the slotting cutter is the standard anti-friction type with four gear contacts, while the vertical spindle is driven by an independent motor mounted on the right end of the rail. Speed changes for the vertical carrier are made through sliding gears and the final drive is obtained through spiral bevel gears.

The heavy rail is doweled to top of the horizontal carrier, which slides on a narrow guide with taper gibbing. There is no overhang for the horizontal arbor as it is supported by a self-oiling aluminum arbor support. Two quick cam clamps are provided, one for the vertical carrier on the rail and the other for the spindle in the carrier. The horizontal carrier and rail unit are clamped on the headstock by shifting the cam lever just above the turret stop. Repetitive settings insuring duplicate work are possible because dial and turret stop arrangements for both the horizontal and vertical carriers are included. Accurate length of the keyway is obtained through the use of the graduated scale mounted on the table chip guard. Two pointers, extending over the scale, are spaced $9\frac{7}{16}$ in. apart, equal to the distance between the spindle carrier centerlines.

This milling machine is made in a number of sizes with any length of bed. Special fixtures for holding the shafts can be supplied on special order.

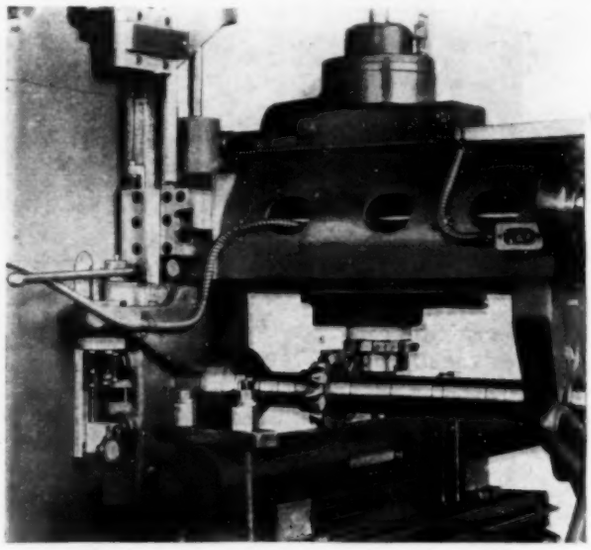


Fig. 2—Rear view showing the lower dial indicator and turret stop, which are used to obtain accurate depth milled by the slotting cutter. The upper dial is employed for setting the rail before positioning the vertical spindle to depth for the rounding out operation

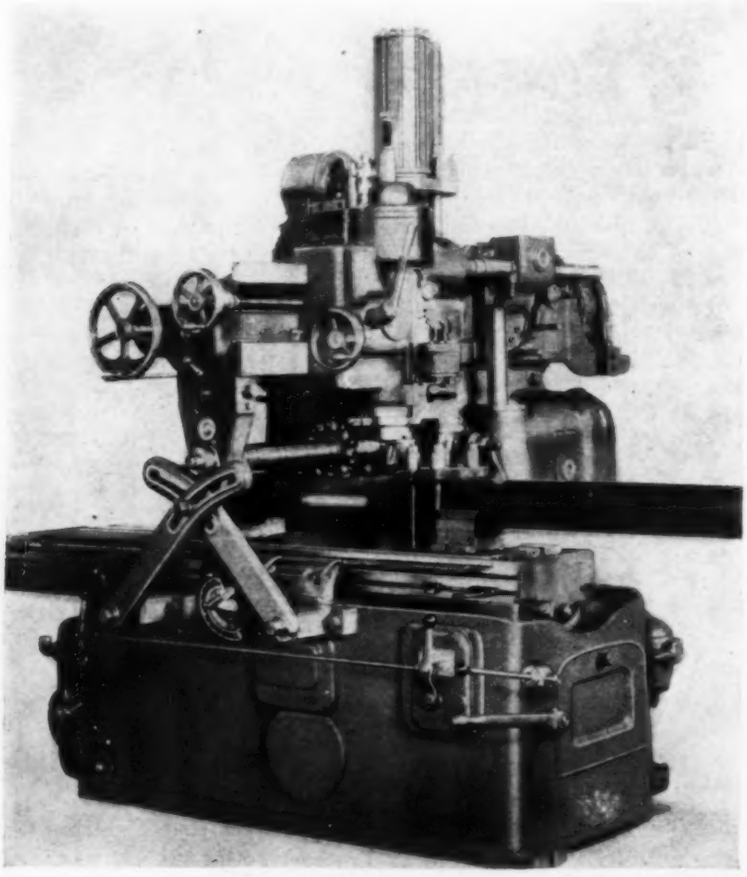
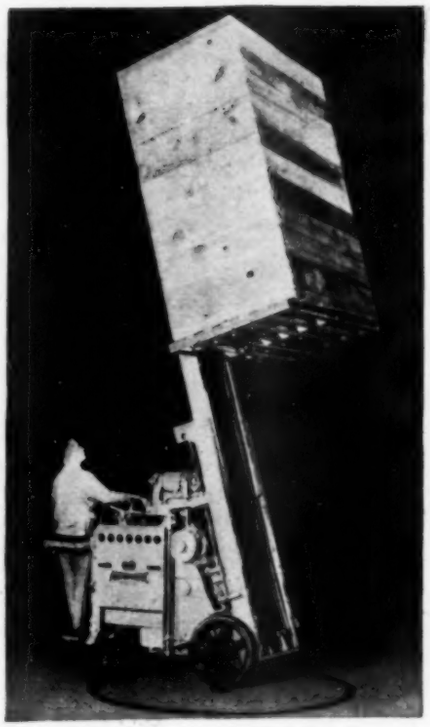


Fig. 1—Cincinnati No. 4-60 Keyway Milling Machine for milling small and round-end keyways. The single directional control lever at the end of the rail regulates the vertical power movement of the rail assembly. A large handwheel provides hand vertical movement

"Automatic" Tilting, Tiering Fork Truck

Telescopic upright members are employed in the tilting, tiering fork truck announced by the Automatic Transportation Co., Inc., 101 W. 87th St., Chicago, Ill., so that tiering



"Automatic" Tilting, Tiering Fork-Type Truck, which is built in capacities from 1,000 to 6,000 lb.

height can be secured to meet practically any operating condition. Capacities of the trucks are from 1,000 to 6,000 lb. A double-roller-chain lifting mechanism is used to give high elevating speed and safety regardless of the position of load. Tilting is accomplished by two heavy-duty links connected to the tilting mechanism. This design insures stability to the upright members regardless of the angle of tilt. The improved controller eliminates arcing and thus insures minimum maintenance expense. The controller affords a combination of foot and hand operation with interlocks on the traction brakes and an automatic return to neutral.

Because of the location of the driving axle, this truck can be turned in its own length. The driving axle is located at the base of the vertical upright. Steering is accomplished through a wheel connected to the two trailing axle wheels located under the battery compartment. Any standard type of storage battery or self-contained gas-electric unit can be put in the battery compartment.

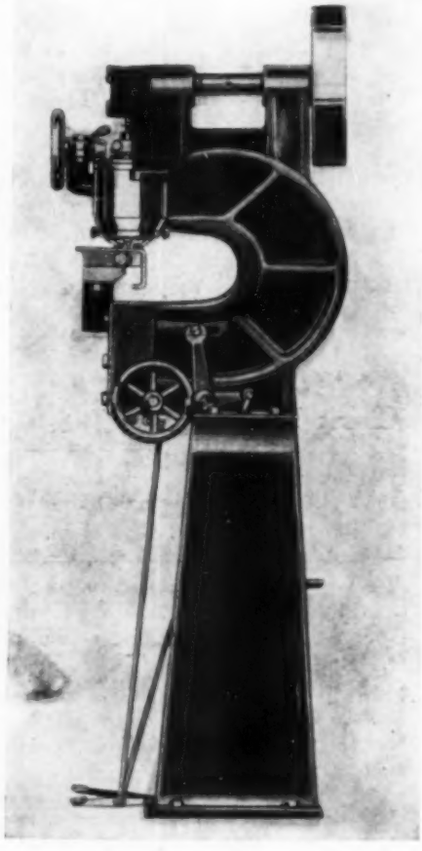
Gray Special Turret Head Metal Cutter for Formed Sheets

A special turret head metal cutter for formed sheets has been developed by the Gray Machine Co., Box 596, Philadelphia, Pa. This machine has found use in cutting openings of various sizes and shapes in large metal switchboard panels, many of which are made in sheet $\frac{3}{16}$ to $\frac{1}{4}$ in. thick. Before the openings are made the panels are formed with a broad flange of about 4 in. and another flange is turned on the edge of the 4-in. flange inwardly on all sides of the panel. It is necessary for these panels to be left without distortion for the proper mounting of the various switches.

A feature of the machine is a bottom die which is mounted on a sliding member. The sliding member has guides to allow the die to drop from 4 to 6 in. downward so that the flanged panel can be passed over the die and under the cutting tool. The sliding member is brought back into cutting operation by the use of the handwheel at the lower front of the machine. A lock pin holds the die-holder in position for cutting.

This type of machine may also be used for ordinary run of work. A short quick-acting lever is employed to drop the die about 1 in. below the cutter when ordinary flat stock is to be cut. This foot-operated lever allows quicker action than the drop handwheel mechanism. Two individually adjusted strippers are also part of the equipment. One stripper is used on top of the master templet, and the other at a lower level to strip the stock below the templet, thus making even stripping on both sides of the cutting tool.

The handwheel at the front near the top of the machine is used for rotating the turret in any direction when straight or irregular cuts are to be effected in panels or sheets that are too large to pass or turn through the throat of the machine. This handwheel turns the turret and changes the direction of cut while in operation, making is unnecessary to turn the sheet. When the pieces are small enough to turn in the throat, the turret head may be locked in any position through 180 deg., as most convenient for the operator.



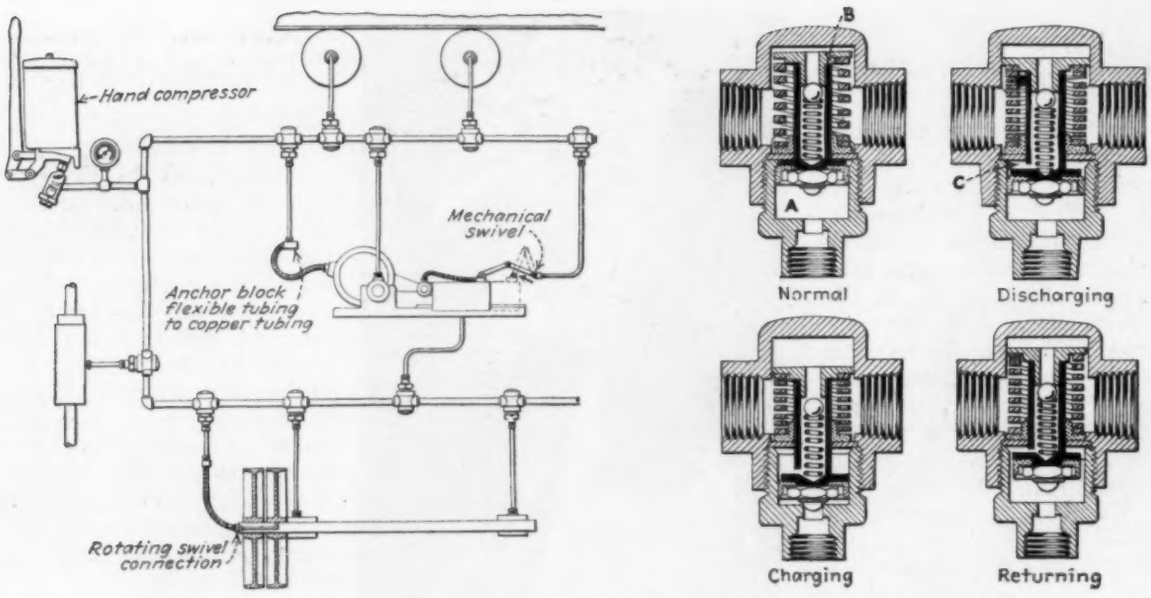
Cutting openings in flanged sheets is facilitated on the Gray Turret-Head Metal Cutter by a special bottom die slide which permits a maximum die opening of 6 in.

Alemite "Metro-Matic" Lubrication System

The "Metro-Matic" lubrication system now offered by the Alemite Corporation, 2650 N. Crawford Ave., Chicago, uses a pipe-line arrangement whereby the lubricant is forced under high pressure to each bearing on the machine. Measuring valves, located at points along the pipe line near the bearings, discharge a predetermined amount of lubricant at each operation of the pump, which is a high-pressure, hand-plunger type. It is claimed that under no condition can the lubricant by-pass to the line; it must go into the bearing. The measuring valves can be connected in multiple, and as many branches as necessary can be taken off at any point.

The hand pump can be filled by hand or by means of standard Alemite filling equipment through a fitting on the base. An indicator shows when the compressor is fully loaded. A 3,000-lb. gage is supplied. The relief valve is at the bottom of the pump for convenient operation. Balking due to air pockets in the lubricant is reduced to a minimum, but should this occur an outlet valve permits the air to be discharged.

The accompanying cross-sectional



Left—Schematic arrangement of the Alemite "Metro-Matic" Lubrication System. Right—Complete cycle of the measuring valve

views show the measuring valve in four positions. From the previous operation there is already a supply of lubricant in the low chamber *A* sufficient to lubricate the bearing. When the pressure is increased to 2,000 lb. per sq.in. throughout the system, the plunger *B* is forced downward, causing the lubricant to pass through the tubing to the bearing. When it is down as far as it can go and the lubricant is in the bearing, the increasing pressure in the pipe line forces the lubricant past the ball check valve and down into the chamber *C*. Then, as the pressure is released throughout the system, the plunger *B* rises and the lubricant above it escapes past the leather jacket into the bottom chamber, where it remains until the cycle is repeated. Eight different sizes of measuring valves may be had with this system.

Clark Finger-Type Lifting and Tiering Truck

A lifting and tiering truck that will pick up cleated loads with 2 in. under-clearance has been announced by the Clark Tructractor Co., Battle Creek, Mich. The load is carried on tapered steel fingers having a standard length of 26 in. These fingers touch the floor in a down position but tilt backward slightly in the first 5 in. of rise to insure balance for the load.

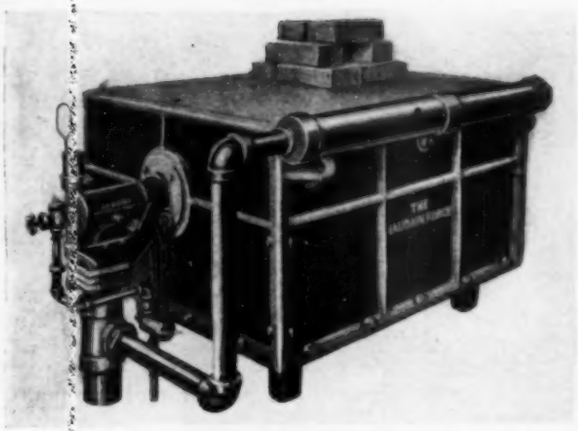
Flexibility in operation is secured by a four-wheel steer and rear-wheel drive. The 2-ton model has a turning radius of 89 in.; 3-ton model, 98 in. The truck is gas-powered for continuous operation. Maximum lifting and carrying capacity is assured by a hydraulic lift. The truck can be operated at speeds from one to six miles per hour.

While the truck is capable of tiering to a height of 50 in., the low over-all height of the machine, 77 in., makes it suitable for loading box cars. Special machines for greater tiering height to meet special conditions are built on the same chassis.

Naudain Production Oil Forge

An oil-fired production forge has been developed by the Naudain Mfg. Co., 1001 Rectory Lane, Baltimore, Md. This forge is constructed of cast-iron plates, strongly ribbed and bolted at the angular corners. The corners are designed to allow for expansion and contraction. A sliding plate is provided at the bottom to open the slag outlet hole under the heating chamber. Lugs are provided on both sides for work rest brackets

Naudain Production Oil Forge equipped with oil burner



and the cooling pipe. The forge can be lighted quickly, and the fuel cost stops when the work is finished. In heating, bending, forging or welding plain or various shaped materials, fire brick can be laid to direct the heat to the desired point.

"Landmaco" 1¼-in. Pipe and Nipple Threading Machine

Several changes have been made in the "Landmaco" threading machine (*AM*—Vol. 74, p. 377) to adapt it to the production of pipe nipples. This 1¼-in. machine is manufactured by the Landis Machine Co., Inc., Waynesboro, Pa. It is made in both single and double head models and is equipped with either externally or internally tripped "Lanco" pipe and nipple threading heads. Its range is ⅛ to 1¼ in. with the externally tripped head and ¼ to 1¼ in. with the internally tripped head.

A single pulley drive with a friction clutch control delivers power to the machine. The clutch is mounted on the outer end of the drive shaft where it is accessible for maintenance. The machine can be motorized at any time by mounting a motor in the motor compartment in the bed.

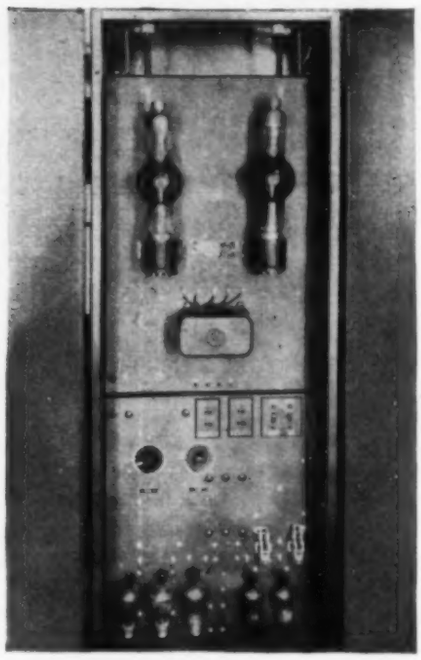
The 8-speed gearbox is of the selective type. It is built into the headstock and is fitted throughout with anti-friction bearings. Gears are made of hardened and burnished chrome-nickel steel. The bearings and gears are lubricated by a flood system.

The spindle is driven by spiral bevel gears, and end play is prevented by preloaded, anti-friction bearings. The diehead is located close to the front spindle bearing to reduce overhang. It may be opened and closed either automatically or by hand.

The carriage is gibbed to the bed and operated by a lever located on either the right or left-hand side. Guides are protected by guards and wipers. The vise has horizontal, sidewise and vertical adjustments, which make possible accurate alignment between the diehead and the work. Vise jaws are driven by bronze vise screw nuts, which are renewable. The low-pressure gear pump is built into the bed, and is driven from the constant-speed shaft in the gearbox. It reverses automatically when the machine is reversed. The bed is of semi-steel and cast in one piece. Large drains below the guides and also at the base of the bed return the coolant overflow to the reservoir.

General Electric "Thyratron" Tube Timing Welding Control

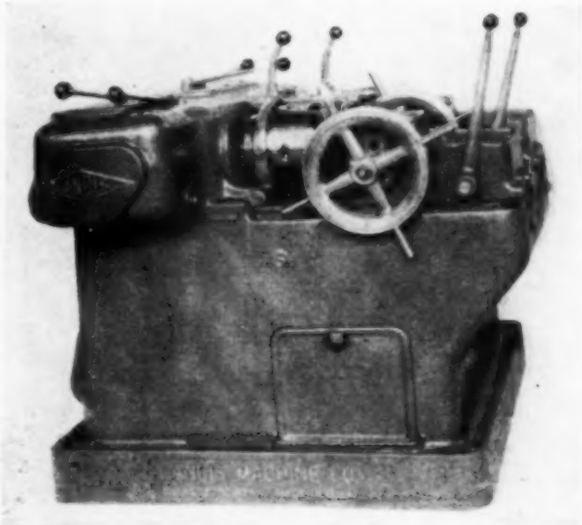
Close and accurate control of the frequency of current interruption in line welding, and an increase in speed of interruptions up to 1800 per min., are found in the "Thyratron" tube timing control announced by the General Electric Co., Schenectady, N. Y. The equipment operates in synchronism with the a.c. supply of the welding machine. The weld is always started at a predetermined point in the voltage wave and stopped when the current passes through zero Thus, the period of current application can be accurately controlled even with "on" times of but one or two cycles.

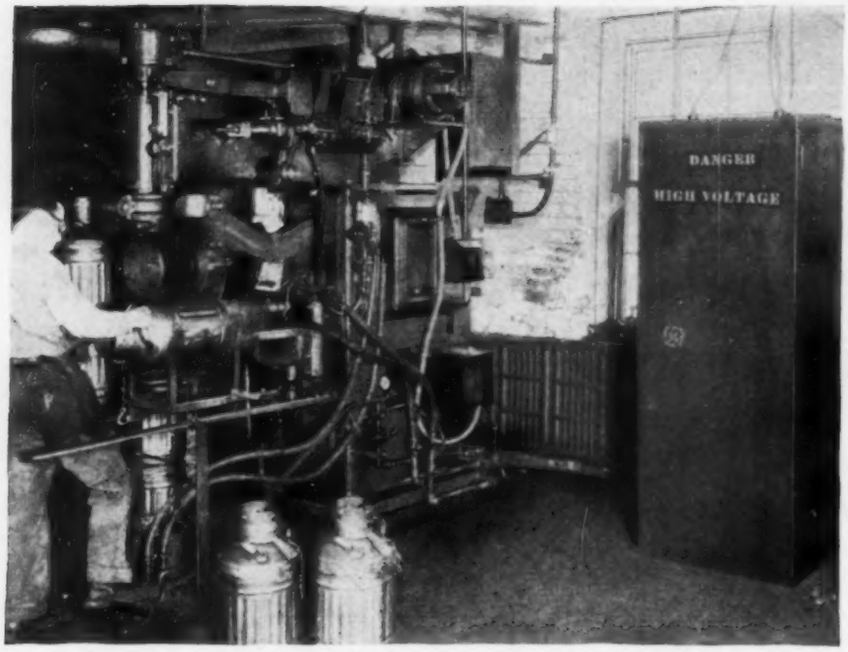


General Electric "Thyratron" Tube Timing Welding Control Panel

The synchronous tube timer supplements, and is designed to work in conjunction with, the welding control Type CR-7503 (*AM*—Vol. 74, p. 845), which used Thyratron tubes instead of contactors for interrupting the flow of current. Close degree of accuracy and a high welding speed are obtained.

The control embodies a series transformer, the primary of which is connected in series with the primary of the welding transformer, and the secondary of which is short circuited by two Thyratron tubes connected thereto. Welding current will not





General Electric Tube Timing Control used in welding side, top and bottom of cans by intermittent line process

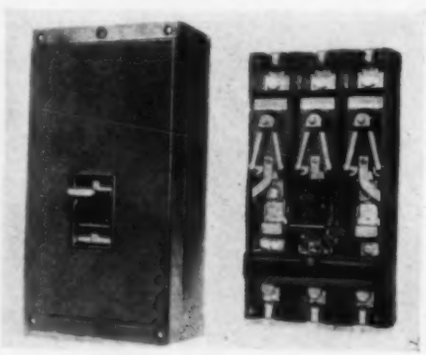
flow unless the grids of these tubes are properly energized. Three small Thyratron tubes control and energize the grids of the larger tubes. One in combination with a condenser acts as a timer. This timing Thyratron trips when the condenser is charged to a certain point and controls the grids of the other two small Thyratrons, which, in turn, control the two power Thyratrons. The control has no moving parts.

Westinghouse Type AB "De-Ion" Circuit Breakers

For motor circuits and general light and power distribution, the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., is offering a Type AB "De-Ion" circuit breaker to replace fused knife switches, safety switches and carbon breakers. Unlike a fuse, the breaker has nothing to be replaced or renewed, and can be reclosed by anyone as quickly and easily as a switch. It cannot be held closed against an abnormal overload or short circuit, nor can it be blocked to prevent opening the circuit. Its rating cannot be changed by unauthorized persons. Furthermore, the time lag prevents unnecessary tripping on slight, momentary overloads.

The "De-Ion" breaker requires only about 70 per cent as much mounting space as a carbon breaker. Unlike the latter, it opens a short circuit without flash or undue noise. The breaker is inclosed in a molded composition box, and a handle protrudes through the cover to provide means for manual operation. The remainder of the mechanism is entirely inclosed.

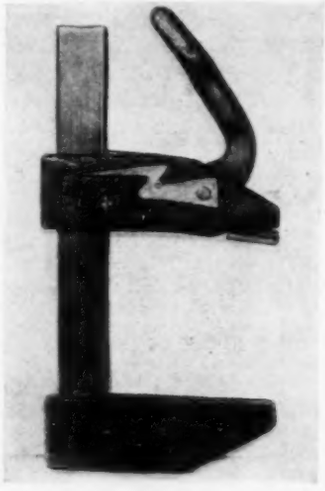
The operating mechanism is arranged to provide quick make and quick break. Contacts, which are trip free, are held in the closed position by a toggle composed of two sets of links, one of which is fulcrumed to the contact mechanism, and the other on a cradle beam pivoted on the frame at one end and latched to the trip mechanism on the other end. The trip mechanism consists of a bi-metal thermal unit calibrated to trip at 125 per cent overload. On breakers of 50 amp. or more an additional trip of the magnetic type trips the breaker instantly on short circuits. Upon being released by the trip mechanism, the cradle beam moves, permitting the contacts to open at high speed. The arc is drawn through a series of small parallel plates $\frac{1}{16}$ in. apart. Between the plates a radial magnetic field is created by a nearby coil. The arc creates another magnetic field which moves the arc into the radial field. The plates absorb so many free ions that the arc is destroyed. A small red indicating neon lamp shows when the breaker is closed.



The 15- to 50-amp. breakers will be available in 1-, 2-, and 3-pole combinations, 125 and 250 volts. The 55- to 600-amp. breakers will be available in 2- and 3-pole combinations up to 575 volts.

"Flash" C-Clamp and Drill Press Vise

The Climax Equipment Co., 5514 W. Lake St., Chicago, Ill., is now offering a quick-acting square C-clamp called the "Flash." This clamp may also be used as a drill press vise. To clamp the material, the upper sliding jaw is released from the upright member by moving the handle in a counter-clockwise direction. With the material between the jaws, the handle is turned in the opposite direction to increase the pressure. This movement binds the upper jaw to the upright, and forces an auxiliary jaw out to take up all play and hold the material rigidly. When the handle is in its normal position, the upper jaw will not slide along the upright. Both the upper and lower jaws are made of nickel cast iron, the lower jaw having the tool steel upright cast in place. Standard sizes are 6, 12 and 18 in.



"American" Vertical Hydraulic Broaching Machines

Both pull-type and push-type vertical hydraulic broaching machines of improved design have been placed on the market by the American Broach & Machine Co., Ann Arbor, Mich. The pull-type machines are manufactured in either semi-automatic or full-automatic types. On the semi-automatic type, the work is merely placed in position and the cycle started by a pedal and hand lever. On the full-automatic type, the work is automatically fed to the broaches and released automatically. All that is required is to have the work brought up to the magazine. These machines are adapted to a wide variety of internal and external broaching operations, and can be equipped to operate one or more broaches at a time.

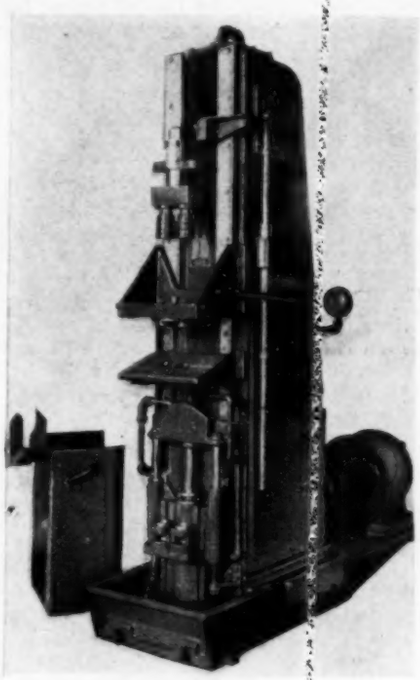


Fig. 1—"American" Vertical Hydraulic Broaching Machine of the pull-type with the lower splash shield removed to expose the lower broach sockets and the elevating cylinder

Fig. 1 shows a pull-type machine with the lower splash shield removed to expose the lower broach sockets and the elevating cylinder. It is unnecessary for the operator to handle the broaches at all. The broaches when in the starting position are supported in the lower sockets at the bottom of the column. These sockets are connected to a hydraulic elevating cylinder. At the start of the cycle the shank ends of the broaches project through the angle table, permitting the work to be dropped over them.

The sequence of operation is as follows: Pressure is applied to the pedal, which causes the lower cylinder to raise the broach elevator. This raises the broaches rapidly and they automatically connect with the pulling head. Immediately after pressing the pedal the operator starts the cutting stroke by pulling down on the hand lever. When the broaches connect with the pull head, they are pulled up through the work on the cutting stroke, meanwhile being flooded with oil through the guide bushing in the angular table. Another stream of oil is applied on top of the work table for washing chips out. After the broaches have passed through the work, the pulling head comes to a stop by means of dogs set for the desired stroke. The work drops from the broaches and slides off the angular table to a receptacle. The machine is reversed by means of a hand lever. When the automatic head comes to its lower position, it instantly releases the broaches, allowing them to drop 6 to 7 in. into the lower receptacles. The drop gives the broaches a slight shock to remove the chips. This type of machine can also be furnished with a magazine feed and hoppers.

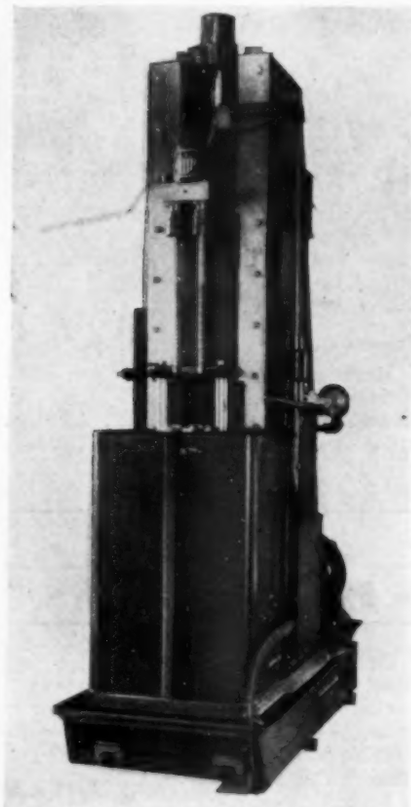


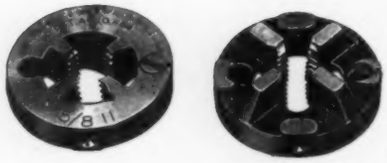
Fig. 2—"American" Vertical Hydraulic Broaching Machine of the push-type which operates on a semi-automatic cycle

The pull-type broaching machines are made in three models—V-52, V-42, and V-32, the figures indicating the maximum length of broach that can be used. The first two machines admit work up to 13 in. in diameter and afford a normal working pressure of 12 tons. The last machine takes work up to 11 in. in diameter and has capacity of 6 tons. Cutting speeds are respectively, 24, 28 and 24 ft. per min.

Vertical hydraulic broaching machines of the push-type are also being offered by the company. These machines are operated on a semi-automatic cycle. Work is placed on a receiving receptacle and the machine started by means of a lever. The lower cylinder receives the broaches and draws them through the work, after which the work is removed and the machine thrown into reverse. The broaches return automatically and connect in the broach heads. The upper cylinder then raises the broaches up for the next stroke. This type of machine is built in several sizes, the smallest of which has a stroke sufficient to operate broaches up to 32 in. over-all length, the largest, broaches up to 58 in.

Wells Screw-Cutting Tools

A line of screw-cutting tools, comprising stocks, dies, taps and screw plates, has been placed on the market by the Wells Tool Co., Greenfield, Mass. The dies, illustrated, are forged from flat bar stock. The lands or teeth project below the body of die, which together with the corresponding openings in the sides of the stock, gives free disposal of the chips. This prevents rough and torn threads. The die is adjusted by turning a taper adjusting screw. For threading close to a shoulder the dies can be turned over and the stock used the other side up. The stocks



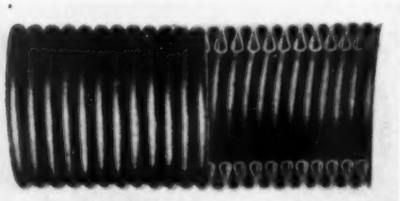
Front and rear of Wells Bolt-Threading Dies

have adjustable guides and are of one-piece malleable iron. An opening in the side provides clearance for chips and a convenient place to apply oil to the thread.

Dies are available for cutting National Coarse and U.S.S. threads and also for cutting National Fine series, as well as A.S.M.E., S.A.E. or U.S.F. threads. The sizes range from $\frac{1}{4}$ to $\frac{3}{4}$ in. Pipe dies from $\frac{1}{8}$ to $\frac{3}{8}$ in. are available. Six standard sets of tools are offered, comprising a metal box, stock, adjustable guide, taps, dies and tap wrench.

American Seamless Flexible Tubing

Seamless flexible tubing, an improved type of flexible metal hose, is being offered by The American Metal Hose Co., Waterbury, Conn., for uses where excessive flexing is encountered, where material to be conveyed would affect the packing in ordinary metal hose fabricated from



Wire braiding covers are used for extreme pressures

metal strip, and also where slight seepage through the packing of ordinary hose would be dangerous, particularly of penetrative liquids or gases. Being fabricated from seamless tubing, this hose is air-tight and leakproof.

While the tubing is suitable for moderate pressures without any outside protection, it can be used for extreme pressures when reinforced with one or more coverings of wire braiding. It is carried in stock in both flexible seamless steel and brass tubing in sizes ranging from inside diameters of $\frac{5}{32}$ to 2 in., but may be fabricated from various other alloys.

• PATENTS •

MARCH 22, 1932

Metal-Working Machinery

Grinding Machine. George W. Binns, Cincinnati, Ohio, assigned to Cincinnati Grinders Incorporated. Patent 1,850,372.

Grinding Machine. Clement Booth, Cincinnati, Ohio, assigned to Cincinnati Grinders Incorporated. Patent 1,850,373.

Machine Tool. Frederick S. Haas, Cincinnati, Ohio, assigned to Cincinnati Grinders Incorporated. Patent 1,850,392.

Duplex Riveting Machine with Anvil Turntable. Arthur R. Havener, Wayland, Mass., assigned to Judson L. Thomson Mfg. Co. Patent 1,850,671.

Grinding Machine, Particularly for Spline-Shafts. Claus Junge, Berlin-Marienfelde, Germany, assigned to Fritz Werner A. G., Berlin-Marienfelde, Germany. Patent 1,850,799.

Sheet Metal Beading and Trimming Machine. Geza M. Horvath, Highland Park, Mich., assigned to Mullins Mfg. Corp. Patent 1,850,958.

Tools and Attachments

Dressing Device for Grinding Elements. Howard D. Colman, Rockford, Ill., assigned to Barber-Colman Co. Patent 1,850,201.

Automatic Drill Head. Sydney C. Watson, Detroit, Mich., assigned to the Bradford Machine Tool Co. Patent 1,850,299.

Safety Device for Hand Fed Power Presses or Like Machines. Lee Le Vasseur, Chicago, Ill. Patent 1,850,404.

Pneumatic Hone. Arthur Joseph O'Brien, Pontiac, Mich., assigned to The Willys-Overland Co. Patent 1,850,847.

Tapping or Tool Holder. Frank P. Miller and Lewis Skeel, Meadville, Pa., assigned to McCrosky Tool Corp. Patent 1,850,938.

Processes

Method of and Apparatus for Electric Resistance Welding. John F. Lawson, Brooooklyn, N. Y. Patent 1,850,176.

• TRADE PUBLICATIONS •

BELT CONVEYORS. A booklet "How Shall We Handle It?" presents various applications of the belt conveyor in some 27 different industries. The publication is distributed by The Diamond Rubber Co., Inc., Akron, Ohio.

FORMING MACHINES. The Niagara Machine & Tool Works, Buffalo, N. Y., offers Bulletin No. 77, on slip roll forming machines, both hand- and power-operated types. Complete specifications and photographs are found in the catalog.

LATHE OPERATION. "How to Run a Lathe," 30th edition, is now being distributed by the South Bend Lathe Works, Technical Service Dept., South Bend, Ind., at 25 cents a copy. Pocket size, the book now contains 160 pages devoted to all kinds of lathe work from installation charts to highly complicated manufacturing operations. Three hundred photographs and drawings illustrate over 400 lathe jobs and shop kinks.

NEW ENGLAND MARKETS. The New England Council and the New England Daily Newspaper Association, Statler Bldg., Boston, Mass., presents a bulletin "Go After the New England Market First," showing the economic strength of New England, an area comprising but 2 per cent of the United States, but having 7.97 per cent of the wealth and 8.4 per cent of the income.

SAFETY REPORTS. Several safety reports are now available from the National Safety Council, Inc., Civic Opera Bldg., 20 N. Wacker Drive, Chicago, Ill., as follows: Three bulletins on transactions of the 20th annual safety congress, being respectively Power Press Section, Automotive and Machine Shop Section, and Metals Section; and three pamphlets entitled "Safety in Structural and Sheet Metal Fabrication," No. Me. 3, "Use and Care of Hoisting Chains," No. 98, and "Safe Practices in Heat-Treating," No. Au.-1.

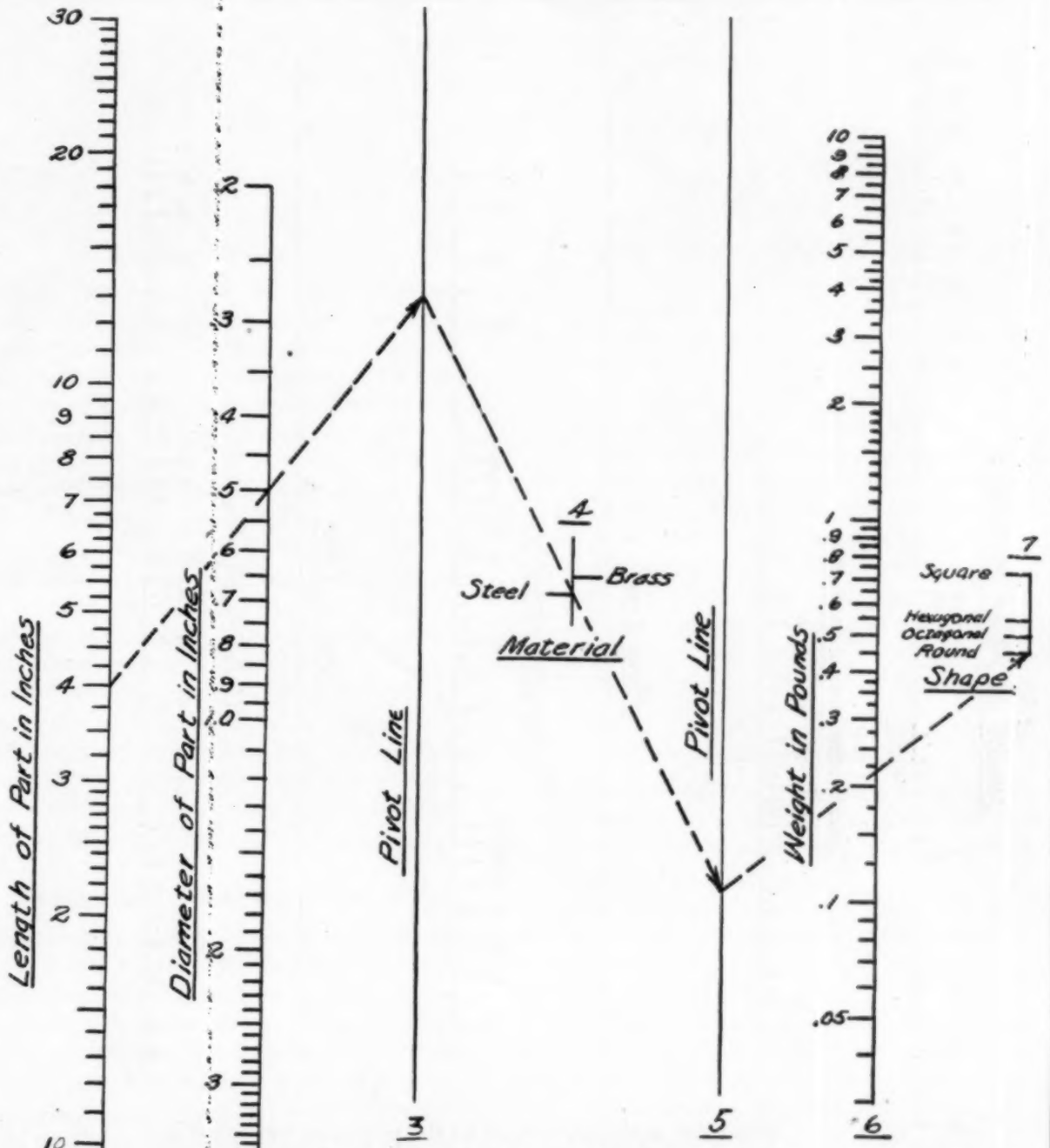
STAMPINGS. The Geometric Stamping Co., Cleveland, Ohio, has compiled a booklet known as "Metals—Stamped and Pressed," being a treatise on standard practice design, engineering data and factors of economy. The booklet is pointed directly to the user of stampings and pressed steel and attempts to show all possible variations in material and methods that must be investigated to provide the best solution for each case.

STANDARDS. The American Standards Association, 29 W. 39th St., New York, N. Y., has issued a recent bulletin listing all standards now in effect. Prices are given.

UNEMPLOYMENT BENEFIT PLANS. The National Metal Trades Association, 122 S. Michigan Ave., Chicago, Ill., states its attitude toward state and private unemployment benefit plans in a 14-page booklet, with chart, recently issued. Among the conclusions are: Federal and State unemployment insurance is unsound; private plans have not been in use for a sufficient length of time to determine whether or not they are successful, and until sufficient experience and data are accumulated the association recommends creation of unemployment benefit reserve funds based upon systematic savings on the part of employees, with or without contributions from the employer, these monies not to be pooled with other funds.

American Machinist
Reference Book Sheet

BRASS AND STEEL ROD AND BAR WEIGHT



This chart, for obtaining weights of steel or brass round, octagonal, hexagonal, and square parts, solves the formula: $W = GLR^2F$, where W is the weight of part in lb., G weight of the material per cu.in. (brass = 0.32, steel = 0.28), L length of part in in. with cut-off included, F a factor depending upon cross-section (1.27 for square, 1.1 for hexagonal, 1.05 for octagonal, 1 for round), and R is radius. On square, hexagonal and octagonal rods, the diameter is the distance across flats.

In using the chart, connect the length of part on line 1 with diameter on line 2, and extend to line 3. From this point pass through the index point for the material to line 5. Connect the point on line 5 with the shape on line 7, and read part weight on line 6.

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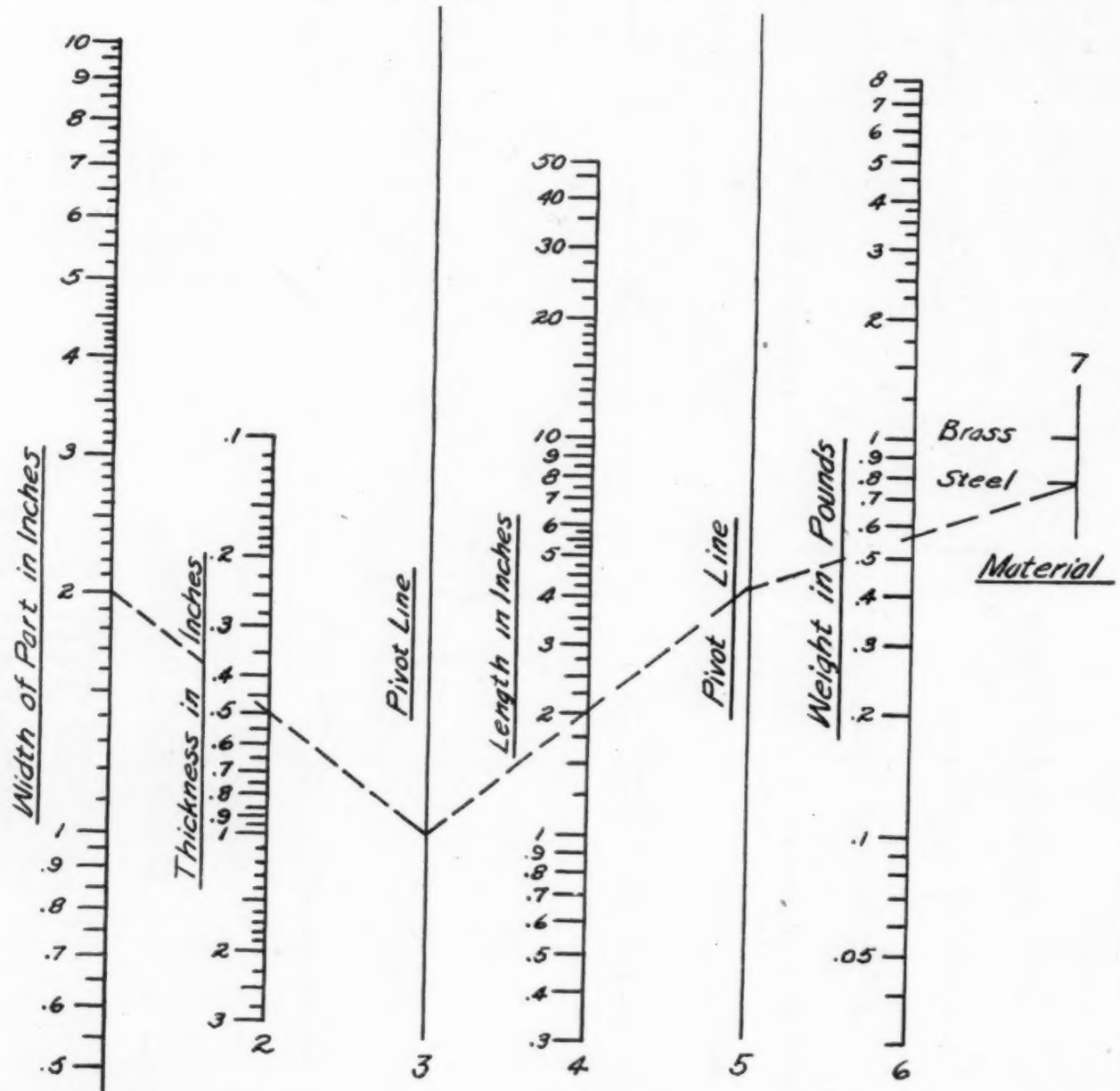
Reference Book Sheet

BRASS AND STEEL ROD AND BAR WEIGHT



This chart is similar to that on the preceding page, but is used for determining the weight of brass or steel bar or sheet parts. Use similarly to the preceding chart, connecting width on line 1 with thickness on line 2 and extending through to line 3. From line 3 pass through length to line 5. Connect this point with material on line 7 and read weight on line 6.

Contributed by Harold H. Herzog,
Industrial Engineer

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EDITORIALS

March 31, 1932

K. H. CONDIT • F. H. COLVIN
Editors

Russian Orders

Soviet planners tell us that the second five-year plan will differ from the first in that industrial construction and equipment will give way to utilities and conveniences for the consumer. To produce such items a different type of equipment will be needed. According to current rumors much of it will be special.

American machinery builders will of course be handicapped by credit restrictions and by the fact that this country is still on a gold basis. Nevertheless, they have one great advantage that should be capitalized—they have wide experience in building special machinery, and what they have built has won an enviable reputation.

Machine tool builders, in particular, should find this possibility of business worth studying. Of late years their regular products have swung more and more rapidly away from regularity and toward specialization. They are consequently in a favorable position to build such equipment.

Management's New Problems

Management becomes increasingly difficult. In the larger sense it must now consider the social as well as the technical aspects of business. Lowered production costs are no longer the only consideration, although always important. Production capacity greatly in excess of reasonable needs indicates just as poor management as the over buying of raw material. Both tie up capital unnecessarily and unwisely.

Management's greatest problem, however, is the prevention of such widespread unemployment as has marked the current depression. It is not enough that we work our way out of this one; a recurrence of such a calamity it sure to bring drastic and radical governmental experiments.

There are, fortunately, several outstanding examples of forward looking management. We have the Swope, the Hook and the Procter & Gamble plans and practices. In addition to the plans themselves, their authors point out the necessity for management's enlarging its scope beyond the cost of production, of recognizing that it has a part in the social structure beyond contributing to community chests or other charitable funds. One can see that it is also quite possible that the limiting of production to economic proportions may become as important as lowered costs per unit of product. From every angle management is faced with more difficult problems than ever before, but the managers who achieve success will have real reason for pride in their accomplishments.

Unbeatable Competition

During the week we spent more time than he could probably spare with one of the ablest and biggest buyers in the industry.

"What am I to do?" he asked. "I'm no price-chiseler or salesman-baiter. I want to play fair; but the salesmen, or their organizations, won't let me."

"How come?" we asked.

"Well, here's an example. Just two weeks ago last Wednesday I call up so-and-so to ask him a price on some pig iron. He told me I could have it for such-and-such. Sounded fair to me, so I told him I'd call back Friday. Something else came up on Friday and I didn't have a chance to call him. I was just about to ring him Saturday and give him the order when the telephone beat me to it. So-and-so was on the wire. 'Say, Fred,' he said, 'about that pig iron. We want the order bad and we'll adjust our price a dollar a ton.' "

"Funny," we said, "the way these price cuts are

always called adjustments. Something like our salary adjustments."

"Right you are," said Fred. "Upshot of it all was that I decided to stall along for a while longer. Didn't call up any other supplier. Just waited. And yesterday so-and-so was on the wire with another cut. What do you make of it? This performance has been practically duplicated in dozens of other transactions."

"You're sure there wasn't any competition against so-and-so?" we asked.

"Nary a compet. I'm beginning to think that the only unbeatable competition that any man has is himself. What do you think?"

• CHIPS •

As per guess of two weeks ago the sales tax is probably permanently mired . . . as much so as a House vote of 223 to 153 can mire it . . . International bankers try to appear greatly perturbed, and dollar exchange dips . . . With one hand President Hoover signs the Norris Anti-Injunction Bill and, presumably, with the other pens a statement that the budget must be balanced . . . He is advised by a vote-hungry Congressional leader that the soldiers' bonus issue will have to be faced this session . . . House rejects beer tax by 216 to 132 . . . Anti-hoarding efforts continue to bear fruit, $157,000,000 having been put back into circulation . . . Receipts on March income tax payments already exceed Treasury estimates by several mllions . . . Senate kills House $136,000,000 Emergency Road Construction Bill . . . proponents still claim it would have provided work for 800,000 men . . . Bankers oppose re-introduced Glass Bank Bill as deflationary, reactionary and confiscatory . . . Banker's victims will thus presume it to have many good points . . . More significant than anything said or done in official Washington is Myron Taylor's prediction of shorter working hours and controlled production for industry . . . It may almost be taken as the considered pronouncement of the House of Morgan.

Europe spends the week in trying to find out where the suicide of Ivar Kreuger left it or put it . . . England, annoyed mildly by renewed bickerings in Ireland, pursues its purposeful, optimistic course . . . Business there is good . . . China and Japan make certain gestures toward trying to negotiate peace for Shanghai, but the Japanese army stands by . . . U.S.S.R. orders 300,000 tons of iron bars and sheets from Germany . . . an additional 200,000 tons may follow if acceptable terms can be arranged . . . France's depression deepens in inverse ratio to her inflow of metallic gold . . . Might be a good joke on France and good business for the whole world to drop the fiction of the gold standard . . . Germany upset by insolvency of various Junkers enterprises but balances budget at $2,000,000,000 . . . 20 per cent under 1931 . . . Mussolini forecasts end of business crisis.

Henry M. Leland, 89, founder of Cadillac and Lincoln, dies in Detroit . . . General Motors announces consolidation of Buick, Oldsmobile and Pontiac sales and of Chevrolet and Oakland (Pontiac) manufacturing . . . proposes exhibitions of all its products in 55 cities, the first to be a New York show at Hotel Astor, April 2–9 . . . also negotiates for purchase of Packard Electric Company . . . Remington Rand, facing anti-trust suit, signs agreement with Weilwerke Aktiengesellschaft (Germany) for mutual interchange of patents and production methods . . .

> Latest figure on United Action Drive to "put a million men back to work" shows that 341,559 have been given regular jobs in 1892 cities and towns . . . an increase of 65,966 during the week.

A new, larger and less expensive Plymouth goes on display April 2 . . . may thus beat Ford to the draw . . . Ford orders 20,000 die-rolled axles for immediate delivery from Republic Steel of Buffalo . . . also 30,000 lbs. of stainless steel from Allegheny Steel Company . . . American Razor Company works 24 hours per day . . . Several departments of Anderson Stove Company work overtime . . . One wonders whether certain executives have heard about schemes for spreading employment . . . New York Central releases orders for 30,000 tons of rails . . . Lackawanna orders 3,000 tons for April and May laying . . . Car-loadings for week ending March 12, total 575,481, a new high for 1932.

Kellett Autogiro will increase production after certain public financing . . . Pittsburgh Steel Company takes over assets and liabilities of its wholly owned subsidiaries, Pittsburgh Steel Products Company and National Steel Fabric Company . . . Business now under single management of Pittsburgh Steel . . . DeForest Radio purchases Jenkins Television Company.

· REGIONAL · REPORTS ·

TOOL DEMAND during the week came mainly from the railroads and the automotive industry. Most companies have tools enough and to spare as legacies from the boom days; can't find work for what they have, let alone buy new. But tools don't last forever and with Spring pick-up in certain industries there must come a demand for replacements.

NEW YORK had a quiet week with only Amtorg fishing for a few special tools. New England found March orders disappointing but refuses to be discouraged. Automotive industry bought several tools and the Navy also was a best customer. Chicago did a little business with the railroads but machine-tool builders have idle plants except for one that is winding up a Ford order. Detroit is still scraping bottom with only slight hopes for any early improvement. All eyes there still turn to Ford, Chevrolet and Plymouth, but inquiries fail to come in, let alone orders.

SPOTTY, says the report on tool sales in Indianapolis, but business there seems to have certain prospects, though limited. Cincinnati shows a shade of improvement. Inquiries come in but orders seldom follow. Storms and a long-delayed spring hold back industries in the South and manufacturers won't buy tools till they themselves get orders.

NEW YORK—Another quiet week for tool dealers. Few inquiries and practically no orders. Amtorg may buy some tools, but this is of no assistance to dealers, since Amtorg itself acts as dealer. Most tool builders willing to sell tools on terms up to a year. Will not meet Soviet wishes for more extended terms, though orders are waiting and no Soviet payment has yet been defaulted. Some special American tools cannot be obtained elsewhere, and Russia needs them immediately—an agreement seems inevitable.

NEW ENGLAND—March orders disappointing but undertone features in situation are far from discouraging. May be realized in automotive developments. Best orders for month from this source and Navy department. Include grinders and lathes, a dozen of latter to one company. Inquiries from Midwest in better volume. New grinding machine orders also reported. One company working on new unit to set mark for speed production of aluminum pistons. Also experimenting with proposed crank-shaft grinder for high-speed production. Worcester companies continue conservatively active with automotive orders, principally for grinders.

CHICAGO—Another dull week. Chicago Great Western's purchase of two floor stand grinders only bright spot. Some cutter and small tools sales reported to railroads in last couple of weeks also helped. One dealer had several hot prospects but no sales; others report few prospects of any kind. Machine tools plants practically idle.

DETROIT—Market for machinery and machine tools unchanged. Still scraping bottom and apparently has only slight expectation of early improvement. Attention is concentrated on Ford, Chevrolet and Plymouth. Ford still buying machinery and tools for production of new models. All industry still awaiting introduction of these cars and most business is at standstill as a result. Some observers believe Chevrolet will step up production in near future. Talk of changes in Chevrolet models unfounded. Plymouth may be in market for new equipment. Inquiries almost non-existent. March probably poorest month.

INDIANAPOLIS—Demand for machinery and machine tools continues spotty. Cold weather has delayed contractors on spring work and buying is light. Iron and steel trade still in doldrums. Railroads have resumed operations in many shops, working with old equipment. Demand for smaller equipment from aviation industry. Should become increasing factor in trade this year. A few sales to farm implement factories, most now in production. Makers of automotive equipment making small purchases, no more than necessary.

CINCINNATI—Business has shown shade of improvement the past few days. Majority of manufacturers receiving practically no orders, however, likewise local selling agents. Considering general conditions, fair number of inquiries come in, but only in rare cases result in orders.

SOUTHWEST—Past three months have presented little new in connection with machine tool and shop supply business. Long hoped-for resumption of activity in local plants and in adjoining fields still unrealized.

SOUTHERN DISTRICT—Sales of machinery and machine tools the past fortnight down in sympathy with general conditions. Severe cold weather and rains interfered with otherwise early spring progress. Resultant crop losses and curtailment of nearly all outdoor activities depending upon good weather conditions. Orders continued of small-lot variety, well scattered geographically. Not a sale of consequence reported. Used machinery and machine-tool sales better. Some indication of thawing out of undesirable stocks.

MATERIAL TRENDS AND PRICES

With scrap prices now at record low levels and the mill operating rate at 25 per cent of capacity (its status since Feb. 27), higher asking prices for ordinary forms of steel are unlikely to materialize. Imports, moreover, tend to depress prices of domestic shapes. While zinc and tin prices are off slightly, this week, most of the commonly used non-ferrous metals remain unchanged as to price.

(All prices as of Mar. 25, 1932)

IRON AND STEEL

Pig Iron —	Current	Mo. Ago	Yr. Ago
Birmingham, No. 2, Fdry., per gross ton	$10@$11	$10@$11	$12.00
Buffalo, No. 2, Fdry., per gross ton	14@ 15	14@ 15	17.50
Heavy Melting Steel Scrap — Pittsburgh consuming point, No. 1, per gross ton	10.00	10.00	12.75
Furnace Coke — Connellsville, per net ton	2.25	2.25	2.50
Foundry Coke — Connellsville, per net ton	3.25	3.25	3.25
Steel Shapes — Pittsburgh, base, per 100 lb.	1.50	1.50	1.65

•

Iron Machinery Castings — Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight, 275 lb.

Chicago....4.62½	Cleveland....4.50	New York....4.75	
Cincinnati....4.35	Detroit....4.00		

•

Steel Sheets — Prices in cents per lb., del. from warehouse stock (except at Pittsburgh) in lots of 401 to 999 lb., ordered and released for shipment at one time:

	Pitts. Mill	Chicago	Cleveland	New York
Hot-rolled, No. 10	1.55	3.20	3.00	3.00
Hot-rolled, No. 24*	2.20	3.55	3.25	3.50
Galvanized, No. 24	2.85	4.10	3.75	4.00

*Annealed

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Seamless Steel Tubing — Cold-drawn mechanical tubing, round, .10 to .30 carbon, in lots of less than 100 ft. or 100 lb., net, at N. Y. warehouse:

Thickness of Wall		Outside Dia. in Inches						
		⅜	½	¾	⅞	1	1¼	1½
Inches	B.w.g.	Price per Foot						
.035	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23

•

Shapes, Plates, Bars, Etc. — Warehouse base prices in cents per lb., del. in lots of 401 to 999 lb., ordered and released for shipment at one time:

	New York	Cleveland	Chicago
Bands	3.40	3.00	2.95
Bars, soft steel	3.10	2.75	2.75
Cold fin., flat or square	3.80	3.60	3.60
Cold fin., round or hexagon	3.30	3.10	3.10
Cold rolled strips	4.95	5.95	5.50
Floor plates	4.85	5.00	5.00
Hoops	3.75	3.55	3.50
Rivets	4.00	3.30	4.00
Shapes	3.10	2.95	3.00
Spring steel	4.00	4.00	4.00
Tank plates	3.10	2.95	3.00

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Stainless Steel — Hot-rolled bars, base, Pittsburgh, 0.12 per cent carbon, cents per lb.:

Chromium		Chromium	
15% and under	19.00	18 to 23%	23.00
15 to 18%	20.50	23 to 30%	28.00

Bolts and Nuts — Discount from list, f.o.b. mills, Birmingham, Chicago, Cleveland and Pittsburgh, on bolts (except stove), nuts, and lag screws, mill lots 75%

NON-FERROUS METALS

Prices following are in cents per lb. for mill shipments in carlots:	
Aluminum ingots 99%, N. Y.	23.30
Copper, electrolytic, Conn	6.00
Copper wire, base, Chicago and Cleveland	8.62½
Copper wire, base, N. Y.	8.50
Lead, pigs, E. St. Louis	3.00
Tin, Straits, pigs, spot, N. Y.	21.70
Zinc, slabs, E. St. Louis	2.77½
Prices following are in cents per lb., base, N. Y., Chi. and Cleve.:	
Brass rods, high	10.25
Brass sheets, high	12.50
Brass tubing, high	15.75
Copper, drawn round	12.87½
Copper sheets	15.37½
Copper tubing	14.87½
Prices following are in cents per lb., del. from N. Y. warehouse:	
Babbitt, anti-friction, general service	29.00
Babbitt, com'l, intermediate grade	34.75
Babbitt, genuine, highest grade	43.50
Solder, bar	17.00
Prices following are in cents per lb., base, Huntington, W. Va.:	
Monel metal rods, hot rolled	35.00
Monel metal sheets, full finished	42.00
Monel metal tubing, seamless	65.00
Nickel rods, hot rolled	45.00
Nickel sheets, full finished	52.00
Nickel tubing, seamless	75.00

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Scrap Non-Ferrous Metals — Dealers' purchasing prices in cents per lb., f.o.b. cars:

	New York	Cleveland	Chicago
Heavy yellow brass	2.00	2.00	1.75
Light brass	1.50	1.25	1.50
No. 1 rod-brass turnings	2.25	2.25	1.75
Heavy copper	4.00	3.25	2.75
Light copper	3.25	2.75	2.50

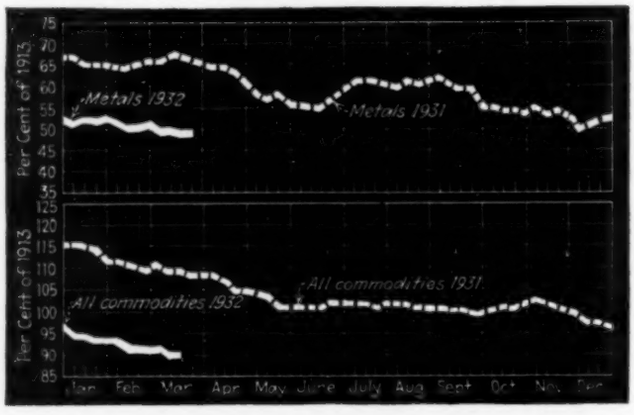
SHOP SUPPLIES

(Prices at warehouse)	New York	Cleveland	Chicago
Abrasive disks, aluminum oxide No. 50 grain, cloth, 6-in. dia., X weight, per 100	$4.37	$4.59	$4.59
Belting, leather, heavy	40–5%	40–5%	40–5%
Belting, rubber, trans., Grade 1	60–10–10%	60–10%	60–10%

Lumber — Per M ft., b.m., 12–16 ft. lengths, delivered, N. Y.

Crating — Southern pine:
1x4-in., sq. ed. ..... $27.00 1x6-in. $24.00

Skids — Spruce:
2x4-in. .$35.00 3x4-in. .$35.00 4x6-in. .$37.00 6x6-in. .$50.00


Per Cent of 1913
Metals 1932
Metals 1931
All commodities 1931
All commodities 1932
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.

Price Movements Week by Week

Average Price of Raw Metals: Pig Iron, Billet Steel, Copper, Tin, Lead, Zinc—American Machinist
Seventy-Four Commodities Index—The Annalist

February Exports of Metal-Working Machinery Up Half Million Dollars

THE VALUE of exports of power driven metal-working machinery in February exceeded the total for January by nearly half a million dollars. The comparison with 1931 continues unfavorable, although various individual items show an increase. The detailed figures as compiled by the Bureau of Foreign and Domestic Commerce follow:

	Feb., 1931	Feb., 1932	Jan., 1932
Engine lathes	$99,636	$121,255	$21,018
Turret lathes	34,739	22,848	11,975
Other lathes	144,614	19,155	26,675
Vertical boring mills and chucking machines	21,967	47,185	82 055
Thread-cutting and automatic screw machines	21,729	31,087	22,249
Knee and column type milling machines	6,414	18,854	.....
Other milling machines	19,394	100,849	17,066
Gear-cutting machines	64,577	63,395	24,112
Vertical drilling machines	140,994	34,636	10,316
Radial drilling machines	11,347	.....	4,840
Other drilling machines	299,071	11,281	33,491
Planers and shapers	20,989	61,421	25,407
Surface grinding machines	20,899	25,328	15,330
External cylindrical grinding machines	96,359	49,582	19,127
Internal grinding machines	267,633	46,005	36,704
Tool-grinding, cutter-grinding and universal grinding machines	44,150	67,746	17,247
Other metal grinding machines	47,772	37,125	13,643
Sheet and plate metal-working machinery	341,393	66,036	40,302
Forging machinery	425,757	151,319	100,131
Rolling-mill machinery	136,743	30,317	18,776
Foundry and molding equipment	85,325	43,450	18 775
Other power driven metal-working machinery and parts	1,326,518	224,796	276 539

Exports of machinery increased in February over January. The total value of February exports was $21,970,723. The increase which amounted to more than $3,000,000 was well divided throughout the list. Items showing increases were electrical machinery, power generating machinery (except electric), mining machinery, power driven metal-working machinery, other metal-working machinery and sewing machines for domestic use. Construction machinery, textile machinery and sewing machines for industrial use showed declines as compared with January. The comparisons with February of 1931 are not so favorable.

	February 1931	February 1932
Electrical machinery	$6,428,329	$4,344,256
Power generating machinery, except electric & automotive	1,075,925	751,541
Construction machinery	785,236	289,483
Mining, well and pumping machinery	2,122,311	1,009,425
Power driven metal-working machinery	3,677,929	1,273,960
Other metal-working machinery	250,242	293,503
Sewing machines for industrial use	193,936	204,677
Other industrial machinery	4,010,926	1,656,498

It will be noted that the value of the exports of other metal-working machinery and of sewing machines increased in February of this year, as compared with February of 1931.

Classified under "other metal-working machinery" in the first table are:

	Feb., 1931	Feb., 1932	Jan., 1932
Pneumatic portable tools	$61,699	$42,624	$32,477
Other portable and hand or foot operated metal-working machines and parts	56,544	33,135	24,455
Chucks for machine tools	12,480	3,949	2,801
Machine-operated pipe and thread cutters, stocks, dies, taps, and other machine-operated cutting tools	22,959	177,109	30,477
Other metal-working machine tools	96,560	36,686	23,747

Silver Bay Institute Program Adds Courses

The 1932 program of Silver Bay Industrial Institute, running from July 8-22, will include special training courses on plant training, industrial supervision, and personnel, under a faculty of well-known production men.

Special attention will be given to the problems of small industries, according to CHARLES R. TOWSON, secretary of the Institute. Encouraged by the results of last year's conference, the Institute Board of Directors has determined to conduct a yearly conference on smaller industries as a part of the regular Institute program. This year's Smaller Industries Conference will be held from July 11-16, and the program will be presented in the main by leaders of industry having fewer than 500 employees. The Industrial Supervisors Division will run from July 8-22, Plant Training Division, July 15-22, Personnel Division, July 8-22, and Smaller Industries, July 11-16. The objective of the Industrial Supervisors Division will be to develop solutions of particular problems rather than general appreciation of responsibilities. Problems in this field will be discussed with reference to men, materials, equipment and operations. The Plant Training Division will analyze and classify different phases of existing plant or company programs of education and training, with respect to the fundamental objectives of each phase, and will study the function and utility of educational methods and procedures in carrying on organized training within an organization.

Navy Tool Awards

Consolidated Machine Tool Corp., Rochester, N. Y., was low on an engine lathe for Boston Navy Yard, and Warner & Swasey Co. was low on a turret lathe for Philadelphia. Cleveland Automatic Machine Co. was low on a screw machine for Philadelphia, and C. F. Bulotti Machinery Co., San Francisco, was low on a milling machine for Mare Island. Awards on tools for which bids were taken some time ago include: milling machine and attachments, Mulhall, Pa., Brown & Sharpe Mfg. Co.; turret lathe, Mare Island, Jones & Lamson Machine Co.; power press brake, Hampton Roads, Smith-Courtney Co.; gang punch and press brake, two units, Kemp Machinery Co.; engine lathe, Mare Island, Jenison Machinery Co.; bolt threading machine, Washington, Landis Machine Co.; power press, Mare Island, Kemp Machinery Co.; crank shaper, New York, Gould & Eberhardt; shaper, Philadelphia, Cincinnati Shaper Co.; power press brake, Philadelphia, Joseph T. Ryerson & Son, Inc.

Navy department closes bids April 5 on two screw cutting lathes for Mare Island and one pipe threading and cutting machine for New York or San Francisco, Mar. 29.

Torrence President of Link Belt Co.

GEORGE PAULL TORRENCE, heretofore vice-president in charge of Indianapolis operations, was elected president of Link-Belt Co., Chicago, at the annual meeting of the stockholders, March 22. He replaces ALFRED KAUFFMANN. A graduate of Purdue University, class of 1908, Mr. Torrence has had 21 years' experience in various departments of the company. Before entering the employ of Link-Belt in Indianapolis as a sales engineer in 1911, he spent a year with Ayer & Lord Tie Co. and two years in the shop apprentice course in the Pittsburgh works of Westinghouse Air Brake Co. In 1915, Mr. Torrence was placed in charge of merchandise and chain sales in the company's western division, with headquarters in Chicago. In 1920 he returned to Indianapolis as sales manager of the Ewart Works. Five years later he was made general manager of both the Dodge and Ewart Plants, and in 1928 vice-president of the company with headquarters in Indianapolis.

JAMES S. WATSON, who, under Mr. Torrence, has been in charge of the Dodge plant of the company, 515 North Holmes Ave., will become vice-president and general manager of the two Indianapolis plants, with F. S. O'NEIL being promoted to assistant general manager, having charge of the Ewart plant on South Belmont Ave.

A.F.A. and A.S.M.E. Plan To Meet Together in May

COMBINED meetings of American Foundrymen's Association, the Management, Maintenance & Materials Handling Divisions of the American Society of Mechanical Engineers, Foundry Equipment Manufacturers' Association, Gray Iron Institute, Malleable Iron Research Institute, and Materials Handling Institute will be held in Detroit during the week of May 2-5. Headquarters of each of these associations will be maintained at Hotel Statler, where all of the technical sessions and business meetings of the various organizations will convene.

Programs of the several meetings are planned for executives, engineers and production men of plants and organizations concerned with castings production and materials handling. Detroit, because of its many industrial plants, will provide further opportunities in the way of planned plant visitations. Papers dealing with important recent developments in the production of all types of castings will be presented at the A.F.A. convention.

Round-table discussion groups have been scheduled, and in addition there will be held, for the benefit of the practical shop men, shop-operation courses on the fundamentals of casting production, such as sand control, foundry facings, furnace operation and heat-treatment.

A.F.A. Tentative Program

Monday, May 2

Registration.
Committee Meetings.
Plant Visitations.
2:00 p.m.—Sand Control Shop Course—Session No. 1.
4:00 p.m.—Gray Iron Shop Course—Session No. 1.

Tuesday, May 3

9:00 a.m.—Sand Control Shop Course—Session No. 2.
9:45 a.m.—Opening Meeting.
10:30 a.m.—Steel Founding: Reports of Committees. "Production and Application of Manganese Steels in Australia," by D. Clark and J. Coutts. (Exchange paper of Bureau of Steel Manufacturers of Australia.) "Manufacture of Stainless Steel Castings," by T. Nelson Holland, Philadelphia. "Some Factors Affecting the Cleanliness of Steel Castings," by Dr. C. H. Herty, Jr., C. F. Christopher and M. W. Lightner, Carnegie Institute of Technology.
10:30 a.m.—Non-ferrous Founding: "Refractories in Brass Melting Practice," by A. E. Rhoads, Detroit Electric Furnace Co. "Phosphorus in Red Brass," by R. W. Parsons, Ohio Brass Co. "A Method for Study of Shrinkage and Its Distribution in Castings," by N. B. Pilling and T. E. Kihlgren, International Nickel Co.
1:00 p.m.—Non-ferrous Cast Metals—Round-Table Discussion. Chairman, Wm. Romanoff, H. Kramer & Co.
1:00 p.m.—Steel Castings—Round-Table Discussion. Chairman, P. E. McKinney, Bethlehem Steel Co.
1:00 p.m.—Gray Iron Founding—Round-Table Discussion. Shop Tests: Fluidity, Step Bar, and Standardization of the Chill Test.
4:00 p.m.—Shop Courses: Steel Founding—Session No. 1. Gray Iron Founding—Session No. 2. Non-ferrous Founding—Session No. 1.
8:00 p.m.—Sand Research: Reports of Committees. "Grain Size and Bond Distribution in Synthetic Molding Sand," by A. H. Dierker, Engineering Experiment Station, Ohio State University. "Mold Condition Control," by H. W. Dietert, U. S. Radiator Corp. "German Sand Control Methods," by Dr. H. Ries, Cornell University.

Wednesday, May 4

9:00 a.m.—Sand Shop Course—Session No. 3.
10:00 a.m.—Non-ferrous Founding: "Casting Properties of Nickel Bronzes," by H. B. Pilling and T. E. Kihlgren, International Nickel Co. "Influence of Design on Brass and Bronze Castings," by L. H. Fawcett, Naval Gun Factory. Non-ferrous Division Business Meeting.
10:00 a.m.—Gray Iron Founding: "Use of Silicon and Manganese Briquettes in the Cupola," by L. H. Ransom, Keystone Driller Co. "High-Test Irons," by H. H. Judson, Goulds Pumps, Inc. "Pearlitic Cast Irons," by H. J. Young. (Exchange paper of Institute of British Foundrymen.) "Use of Molybdenum in Cast Iron," by J. Kent Smith and E. R. Young.
12:30 p.m.—Pattern Production Round-Table Discussion. Modern Premium Systems Pertaining to the Pattern Shop. Pattern Production Standards.
2:00 p.m.—Apprentice Training: "How Much Does It Cost to Train Foundry Apprentices?" by J. Franklin Carlz, Clark Bros. Co. "Successful Foundry Apprenticeship in a Small Manufacturing Plant," by W. E. Rutz, Giddings & Lewis Machine Tool Co.
4:00 p.m.—Shop Courses: Steel Founding—Session No. 2. Gray Iron Founding—Session No. 3. Non-ferrous Founding—Session No. 2.
7:00 p.m.—Informal Stag Dinner of American Foundrymen's Association and Foundry Equipment Manufacturers' Association.

Thursday, May 5

9:00 a.m.—Sand Control Shop Course—Session No. 4.
9:30 a.m.—Annual Business Meeting of A.F.A.
10:30 a.m.—Gray Iron Founding: "Melting High-Test Iron in the Brackelsberg Furnace," by D. J. Reese, Whiting Corp. "A Shop Method for Determining Volume Changes Occurring in Cast Iron During Melting," by C. M. Saeger, Jr., and E. J. Ash, U. S. Bureau of Standards. "The Open-Hearth Furnace as a Means of Recovering Cast Iron Borings," by T. L. Joseph and C. E. Wood, U. S. Bureau of Mines.
10:30 a.m.—Malleable Founding: "High-Silicon Pig Iron for Malleable Iron Manufacture," by A. L. Boegehold, General Motors Research Laboratory, and C. F. Joseph, Saginaw Malleable Iron Co. "Short-Cycle Malleabilizing," by H. W. Highriter, Malleable Iron Research Institute, and R. Schneidewind, University of Michigan. "Effect of Thermal Treatment on Characteristics of Black-Heart Malleable Iron," by Dr. Tario Kikuta, Tobato Foundry Co., Japan.
1:00 p.m.—Malleable Round-Table Discussion. Chairman, R. J. Teetor, Cadillac Malleable Iron Co., Cadillac, Mich.
2:00 p.m.—Materials Handling (A.S.M.E. Cooperating). "Monorail Materials Handling and the Foundry," by J. B. Forker, Osborn Mfg. Co. "Materials Handling for Miscellaneous Castings," by F. D. Campbell, Eastern Corp. "Materials Handling in the Small Brass Foundry," by D. G. Anderson and B. F. McAuley, Western Electric Co.
4:00 p.m.—Shop Courses: Gray Iron Founding—Session No. 4. Non-ferrous Founding—Session No. 3.

Friday, May 6

Plant Visitations.

Tentative Program "Three M" Congress

The tentative program for the meetings of the A.S.M.E. divisions will feature papers and discussion on management, maintenance and materials handling problems.

Wednesday, May 4

Morning—Maintenance and Materials Handling Session.
Noon—Luncheon Meeting—Discussion on Export Trade
Afternoon—Inspection Trip to Ford Motor Co.
Evening—Dinner for A.S.M.E. Members—*Detroit Yacht Club.*

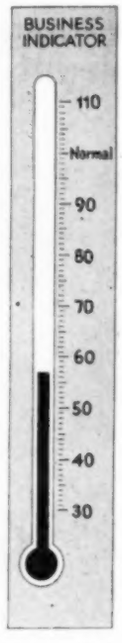
Thursday, May 5

Morning—Joint Management and Materials Handling Session
Noon — Luncheon Meeting — Address: "Knowledge of Markets and Its Effect on Design," by Prof. R. F. Elder, Massachusetts Institute of Technology
Afternoon—(a) Symposium—Waste Elimination
(b) Management Session
(c) Joint Materials Handling Session with American Foundrymen's Association
Evening—Dinner and Smoker—Materials Handling Institute and Manufacturers' Committee of A.S.M.E. Materials Handling Division.

THE BUSINESS WEEK

March 30, 1932

The only concrete accomplishment of Administration anti-deflation measures so far has been to reduce bank suspensions and currency hoarding, postpone railroad receiverships, steady security markets, support federal financing and increase bank liquidity . . . No evidence of credit expansion is yet forthcoming, and opposition among bankers to further aggressive easy-money pressure by Federal Reserve policies is developing . . . Most business indicators continue to recede, aside from spurts in coal production and shipments due to weather and strike conditions . . . Steel activity still waits upon a spring pick-up in automobile output, and this in turn upon Ford plans . . . Merchandise freight distribution and department store trade continue to decline, partly under unfavorable weather factors . . . Hesitancy in the heavy industries is contributing to declining power production . . . March building figures show the consequences of almost complete suspension of public improvements, which is offsetting the slight, sporadic improvement in employment stimulated by local drives . . . Commodity prices have weakened acutely in the past week . . . Prospects for improvement in the business picture in the next two months depend principally upon the outcome of the automobile sales drive under way, alteration in banking attitude toward credit expansion, and settlement of the federal tax issue . . . A pronounced pick-up in domestic business before June will help offset further disturbance due to European political and financial and difficulties which are likely to come to a head by that time . . . Encouraging developments in England and the Orient are being counterbalanced by increased strain on the Continent.



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Machine Tool of the Future: Its Rigidity and Beauty

EVERETT CHAPMAN
Director of Engineering and Research, Lukenweld, Inc.

MACHINE tool stiffness is obtained by selecting the best shapes for the given set of load conditions. Machine tool loads are neither simple nor in a few planes; they are extremely complex and in many different directions. A shape should be used therefore which is known to be capable of resisting effectively loads in every direction and having considerable eccentricity. It is significant that the choice of every good engineer for maximum rigidity under such conditions is a box or tubular section. The most important characteristic of the closed tube or box to the machine tool builder is its high torsional rigidity. These sections possess the greatest amount of torsional strength for the least amount of metal. To the writer, this is the question of stiffness is the most neglected important subject in the entire panorama of machine design. Torsional distortion is angular displacement, and as such may add up to a distressing amount of misalignment, even when the length of a machine is nominal. A great deal of beam strength is not required in machine tools, so that the superior strength of steel does not enter the picture. What is really wanted is beam stiffness and, what is still more important, torsional stiffness. A pair of ways cocked with respect to each other do not form a workable mechanism, if alignment of the parts which slide on them is to be maintained.

"Picture-Frame Bases"

Consider such a simple thing as a base, on one end of which there is a torque producing unit and on the other end of which there is a torque absorbing unit. A cast-iron base well boxed and ribbed will possess a fair and reasonable degree of stiffness. It is entirely conceivable that an engineer can use a stiffer material such as steel and make a base which is considerably flimsier than this well boxed cast-iron base. This has been done in many instances—the so-called "picture-frame bases" which have achieved some degree of notoriety as argumentative proof of the flimsiness of steel. While the material of which these bases are composed is superior in stiffness to cast iron, the metal has been shaped without regard for the type of loading, hence a markedly inferior base results. Use of steel, however, to build a box section with an equivalent moment of inertia will achieve immediately an equal stiffness with considerably less metal, for two reasons, first, the substitution of the steel which is stiffer, and secondly, because it is impossible to cast a completely closed box section because of the cores which must be supported. These core supports will very often rob the section of a considerable amount of important metal. A completely closed box can be made with the important metal placed where it will do the most good by welded construction. In emphasizing this freedom of welded design, it is worthwhile to describe a type of plate construction of crane girders which achieves an astonishing amount of torsional rigidity using the same amount of metal as the conventional design but placed in a different manner. An open I or H section is poor in torsion and yet it is possible with plates in a latticed form to develop a great amount of torsional stiffness even in an open channel. This rigidity increases, of course, when the bottom flange is applied to form the box. The design is similar to the simple girder or zig-zag diagonal form used in riveted girder construction. An iron bed cast in this form will possess a considerably greater amount of torsional stiffness than a bed cast in conventional manner, but will be more expensive.

Consider the elementary case of a lathe bed. Fig. 1 contrasts the usual type of cast-iron bed with a possible welded steel design. It is obvious that in a lathe bed we wish to hold the tool up to the work, both to insure the accuracy of the finished product and to eliminate chattering. Frequency and amplitude with which the tool springs away from the work due to the imposed load and then springs back again by virtue of the consequent load relief is chatter. This phenomenon can conceivably be brought into resonance with some part of the machine. This is vibration. In a lathe bed, we have to contend with a downward off-angle thrust which does not go through the center of twist to the bed, which makes the bed loading predominately torsional. The conventional lathe bed design shown on the left consists of cross ribs joining two heavy I-section ways upon which the carriage and tailstock slide. This conventional design if made heavy enough is perfectly satisfactory for most work.

The good engineer's answer to a torsional load is a tubular section, but because of practical considerations of chip disposal and casting practices it has been considered expedient to keep the bed open between the two I sections to allow the chips to fall through into pans. We have thus compromised our engineering with a section which is not ideally adapted for torsional loading. However, if we substitute steel for cast iron, cross-section for cross-section, placing the material exactly as it was placed before, we will have a lathe bed two and one-half times as stiff as the iron bed. The fallacy in a considerable number of welded designs lies in the attempt to take advantage of the two and one-half factor by thinning the metal sections in this copied structure. Not handling the design constants in the proper manner has inevitably resulted in thinning the metal where it should not have been reduced. It is possible to redesign this double I-section bed to obtain ten times the torsional stiffness possible in cast iron by using less metal of a higher elastic modulus. Contrast the old design with that of the right-hand figure of the illustration.

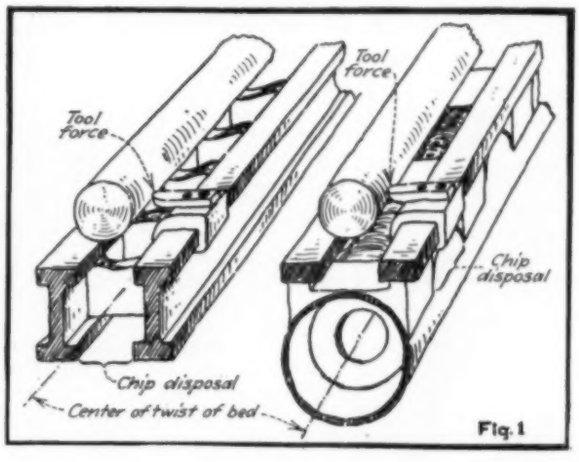
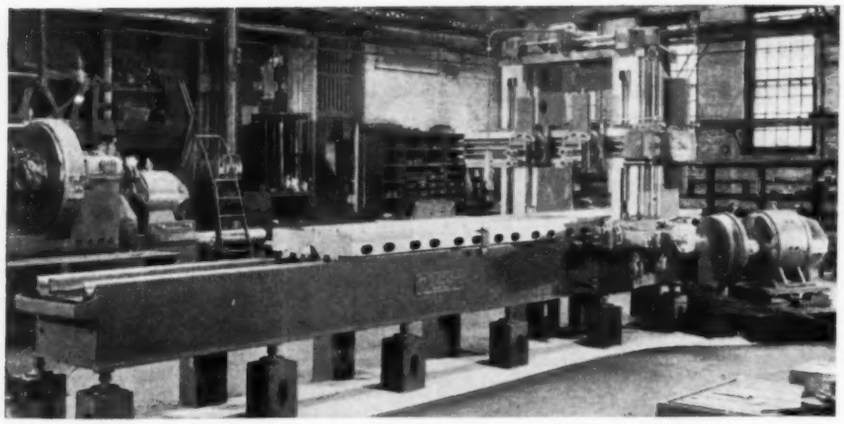


Fig. 1

Chip Disposal Secondary

To establish mentally the ideal backbone for the new bed, let us consider the chip disposal problem as secondary. Let us use the most ideal torsional section we know of, a tube. In mounting the ways on this tube we may use short bridge-like members straddling the tube as illustrated and between these bridge-like members we will support the ways by inserting arched ribs. The chips can slide over the rounded surface and out through the holes into disposal pans which solves our secondary problem. Calculations will dictate a rather thin metal section and it will be necessary to guard against possible secondary stresses by properly diaphragming this tube. Round diaphragms are as good a drumhead as there is, but cutting holes in the center of them will destroy their efficiency as a sounding board. Many things have been accomplished in shifting from the left-hand design to the right by taking full advantage of our two fundamental endowments: stiffer material and engineering freedom. It is in changes of design of this character

Abstract of a paper presented at a joint meeting of the Metropolitan-Plainfield sections of the Machine Shop Practice Division, A.S.M.E., March 17.



A 42-in. Sellers planer, with welded steel housings, bed and table, an example of possibilities in welded machine tool construction

that the great economies of welded steel are to be found. Merely substituting steel for cast iron, section for section, not only is horribly uneconomical, but in addition we inherit all the fundamental troubles due to previous compromises with the method of fabrication.

Thin-Section Vibration

What of the vibrations of the thin sections that are now open to us? Any structure ever made has a natural period of vibration, a frequency at which it will freely vibrate if struck. Twenty feet of rope slung over the limb of a tree, 85 lb. of child seated on a board at the bottom of the sling will, if given a push, oscillate freely at a certain frequency. Shortening the ropes will make the system vibrate faster; filling the child with lead makes it vibrate slower. The period of these natural frequencies of a structure is determined by the product of the mass of the vibrating part and the stiffness associated with that mass. A heavy, chunky structure will vibrate naturally at a low frequency while a light stiff structure has a high natural frequency. The other very pertinent point is that if these natural frequencies are not excited, the structure will not vibrate. The rope and child combination will never move if someone does not push it. The problem of vibration in machine tools and the attendant chattering is then a problem of dealing with the probabilities of exciting one of the natural frequencies of the structure. Many structures have several degrees of freedom, which means that they can vibrate at several different frequencies. One part can vibrate at a certain frequency, this part in combination with another part has a different natural period; but oscillation at these various frequencies will not occur if nothing excites them.

To excite these vibrations, we must apply a periodic force, one which is constantly recurring at a definite rate. Probably the worst offender of this sort is the following phenomenon: the pressure of the work on the tool causes the lathe bed to spring away from the work whereupon the tool load is lightened and the bed tends to return to its original position, at which the force increases and the bed once more springs away from the work: this is chattering in its worst form and may produce severe vibrations in other parts of the bed. Another source of frequencies in a machine tool structure are poorly cut gears. Gears with backlash, driving a good-sized load through a long shaft, will result in a periodic torsional springing of the shaft. The machine tool profession can probably make a list a foot long of these various exciting influences. The brute force way of stamping out resulting vibration is to make the piece very heavy with a low natural frequency. The probability of exciting this frequency will be small: if we do, however, we make it still heavier. It is just as feasible and somewhat less costly to make the bed very stiff. This also reduces the probability of natural excitation. Before the destructive failures of turbine wheels were definitely stopped, it was necessary to find out at what speeds certain turbine wheels must not be run. Once this was accomplished all failures ceased. It is probable that an equivalent amount of research work would definitely repay the machine tool industry many times its cost, not in the elimination of natural vibration, which is impossible, but in the scientific avoidance of a union between a natural frequency and a forced vibration. As long as we cannot eliminate the forcing sources in our tools, we can, at least avoid matching them up with those points at which the structure would like to vibrate.

Avoid "Drum Heads"

"Drum heads" need not be deliberately incorporated in a design. This is easy if one knows a drum head when one sees it. The best drum head is round: ribbing or crowning this round head will raise its natural frequency out of the danger range. Triangular unsupported areas are not particularly good drum heads, and lattice construction incorporates these triangles naturally.

Another important reason for avoiding vibration in any structure is the possibilities of fatigue failure. Vibration stresses and especially those at a resonance point will impose extremely heavy stresses at an abrupt change in contour. Fatigue failures will terminate the useful life of a machine without warning and this potentiality is a very costly guest to entertain. It is again a matter of proper engineering. Steel as a fatigue-resisting material is at least twice as good as cast iron. Any fatigue failures that occur in a redesigned and welded steel structure are squarely up to the man who designed it. He must know considerable about stress distribution, where concentrated stresses occur, he must incorporate gradual changes in contour at points of high bending moment and last, but by no means the least, he must know the fatigue properties of the parent metal, the weld metal, and the parent metal adjacent the weld where several metallurgical damage can take.

A.S.M.E. Aeronautic Meetings in June

T. P. WRIGHT, vice-president, Curtiss Airplane Motor Co., Buffalo, is general chairman of arrangements for the sixth national aeronautic meeting of the A.S.M.E., to be held by the Aeronautic Division of the Society at Buffalo, N. Y., on June 6 and 8. About 30 technical papers and reports from two special committees will be presented. The technical program is being arranged by PROF. ALEXANDER KLEMIN of New York University.

A Pacific Coast Aeronautic Meeting is to be held at the University of California June 9 and 10 with PROF. B. M. WOODS, chairman of the Program Committee. Three technical sessions and an inspection trip will be included in the meeting. Among papers to be presented are two on "Thin Walled Structures," one on "Turbulence Problems," and another on "The Effect of Fillets on Wing Fuselage Interference."

G. E. Coffin Awards Go To 22 Men

Constructive ideas have won recognition for twenty-two employees of General Electric Co. Awards under the Charles A. Coffin Foundation, established by the company in 1922 as a tribute to its first president, have been presented to twelve factory employes, eight engineers and two salesmen. Four of the winning suggestions had to do with the manufacture of electric refrigerators and four others were concerned with electric welding in its various applications. Three engineers at the Pittsfield, Mass. works were cited jointly for development of a new substance known as Thyrite, which has the remarkable characteristic of being a good electrical insulator at low voltages and an excellent electrical conductor at high voltages.

Tool Name Survey Announced by A.S.A.

Serious confusion in the names applied to lathe tools even by experts has been revealed in a limited survey conducted by the A.S.A. The survey showed that experts did not agree even as to what was a left-hand tool and what a right-hand tool. What one expert called a right-hand straight turning tool was designated by another as a left-hand straight roughing tool. In another case a tool was variously called a left-hand side-boring tool and a right-hand hook tool, while a third reply called it a right-hand boring tool.

As a result of this confusion, the sectional committee on small tools and machine tool elements, organized under A.S.A. procedure, has set up a new subcommittee on nomenclature which will attempt to prepare a nationally acceptable nomenclature for lathe and other tools. The questionnaire on lathe tools, which was sent out as the result of a request of a foreign national standardizing body for information on nomenclature for lathe tools used in this country included sketches of the most commonly used shapes of lathe tools.

The A.S.A. has announced publication by the A.S.M.E. of the American Standard for cast-iron pipe flanges and flanged fittings for maximum non-shock working hydraulic pressure of 800 lb. per sq.in. gage at ordinary air temperatures.

Joins in A.S.A. Work

The Society of Sanitary Engineering has joined the National Industrial Standards Association work under procedure of the American Standards Association. A. R. McGONEGAL, secretary of the Society and chief plumbing inspector for the District of Columbia, will represent the Society on the governing council of the A.S.A.

Industrial Earnings Comparisons

Aggregate earnings for 1931 of 379 representative industrial corporations were 78.09 per cent less than for the peak year 1929, but in 1921 as compared with 1920 the decline shown by the same companies was 91.64 per cent, according to compilations from published reports, announced by Ernst & Ernst, public accountants. The study includes all industrial corporations whose figures are available for 1929 and 1931 and also for 1920 and 1921—379 in all, classified into seventeen industrial lines and miscellaneous.

The deflation of the 1920-1921 depression period, it is pointed out, took place principally in the year 1921, although in certain cases at least a portion of it was in 1920. Approximate adjustments for these and other factors, it is said, indicate that the study represents a conservative statement of the aggregate shrinkage in corporation earnings for the 1920-1921 depression.

Another compilation by Ernst & Ernst covering the earnings of 1,188 industrial corporations shows a decline of 78.24 per cent for 1931 as compared with 1929, and a decline of 74.14 per cent, 1931 compared with 1928. Of the 1,188 companies, 146 or 12.3 per cent improved their earnings in 1931 over 1929, while 200 or 16.8 per cent did better than in 1928.

For comparison of 1931 with 1930, published figures are available from 1,389 industrials, whose aggregate earnings for 1931 were $628,341,000, a decrease of 61.17 per cent from the aggregate of $1,618,025,000 reported by the same companies for 1930. Better operating results in 1931 than 1930 are shown by 359 of these companies or 25.8 per cent. Operating profits were made in 1931 by 846 or 61 per cent, while 543 or 39 per cent showed losses. A similar compilation covering the companies whose figures are available for the year 1921 discloses that the proportion of companies showing profit or loss is approximately the same.

• BUSINESS ITEMS •

American Foundry Co., Indianapolis, Ind., has resumed operations after a shutdown of many weeks, employing about half the usual number of employees. The foundry will operate at present on a four-day week but expects to step up operations late this Spring. Its principal manufacture is gray iron castings for use in automobiles.

Missouri, Kansas & Texas Railroad has added 1,000 men, 400 of them in repair shops. New York Central Lines has also added to its staff, as has Peninsular Railroad at Shelton, Wash. Southern Railway Co. has added to its force at the Spencer Shops, Salisbury, N. C. Transcontinental & Western Air Lines has added 31 men to its Kansas City maintenance shop.

Kellett Autogiro Corp., New York, is soon to step up production, according to an announcement in connection with an increase in stock.

American Telephone & Telegraph Co. has reduced employment by one-half day a week, beginning May 1.

Anderson (Ind.) Stove Works is operating full time six days a week and operating some departments overtime to meet the production schedule required to fill its orders, according to WILLIAM QUINN, president.

Purchases, Branches, Licenses

Industrial X-Ray Laboratory has been established at 1349 Milwaukee Ave. E., Detroit, Mich., for X-ray examination of steel, iron, brass, wood, clay or insulating material objects. R. K. WELCHLI and L. L. DICKERSON are in charge. The laboratory is equipped to radiograph thicknesses up to 2 in. of iron or steel and 6 in. of aluminum and will soon have equipment capable of radiographing up to 3½ in. of steel and 8 to 10 in. of aluminum.

Remington Rand Co., New York City, has signed an agreement with Weilwerke Aktiengesellschaft for mutual exchange of patents and production methods. The German company manufactures bicycles and typewriters.

De Forest Radio Co. has purchased the assets of Jenkins Television Corp., according to LESLIE S. GORDON, president of both organizations.

Columbia Electric Mfg. Co., Cleveland, Ohio, has formed an Electro-Chemical division which will handle a complete line of polishing and plating equipment and supplies. F. G. CYREX will organize and operate the new division, acting as manager and chief engineer. Until recently he was with Hansen - VanWinkle - Munning Co. as chief of the equipment division.

American Screw Co., Providence, R. I., has been licensed by Dardelet Threadlock Corp., 120 Broadway, N. Y. C., to manufacture and sell bolts, nuts, and screws threaded with Dardelet self-locking thread.

Western Screw Mfg. Co., Chicago, Ill., has been licensed by Dardelet Threadlock Corp., 120 Broadway, New York, N. Y., to manufacture and sell bolts, nuts, and screws threaded with Dardelet self-locking thread.

Reliance Electric & Engineering Co., 1042-1090 Ivanhoe Rd., Cleveland, Ohio, has established a sales branch at 703 Bona Allen Bldg., Atlanta, Ga., in charge of MARSHALL WHITMAN and GEORGE GARDNER. The territory will include North and South Carolina and Georgia.

Orders

New York Central Railroad will order 30,000 tons of rail within a few days. This is the smallest annual allotment ordered by the road in the past 30 years.

Of the 30,000-ton rail order announced by New York Central Railroad, about 24,000 tons represents new requirements and about 6,000 carry-over from last year's order. The new order will be divided among Bethlehem Steel, Inland Steel, Carnegie Steel, Illinois Steel and Algoma Steel.

Miscellaneous

Dan Shea Boiler Works, 1106-1108 Kansas Ave., Memphis, Tenn., burned

March 11, with a total loss of $76,000, covered by insurance.

The entire pattern department of Crawford & McCrimmon Foundry & Machine Works, Brazil, Ind., was destroyed by fire recently. The plant had been shut down for some time. Patterns were for the manufacture of engines, pumps and machine tools made by the company.

Plans for the second unit of the new mechanical engineering building at Purdue University have been approved and bids will be received April 5. The building is three stories, of brick, concrete and steel with stone trim and will cost $200,000. Offices and laboratories and other work of the engineering school will be concentrated there.

Notice is being sent out by Dayton Rubber Mfg. Co. and Allis-Chalmers Mfg. Co. that the suit of Dayton Rubber against Allis-Chalmers in United States District Court, involving patent infringement pertaining to Multiple V-belt drives, has been settled out of court by the contending parties effecting a mutually satisfactory commercial working arrangement, under which Dayton takes a license under the Geist Patent No. 1,662,511, and Allis-Chalmers can operate under the Short Patent No. 1,538,303.

Reorganization of part of the General Motors manufacturing and sales division has been announced by ALFRED P. SLOAN, JR., president. Oldsmobile division has been consolidated with Buick Motor division as of April 1, under I. J. REUTER as general manager. He has been general manager of the Oakland division. Oakland Motor division manufacturing will be co-ordinated with Chevrolet Motor division under W. S. KNUDSEN, as general manager.

• PERSONALS •

GEORGE R. CASEY has been elected vice-president and general manager of Treadwell Engineering Co., Easton, Pa., to succeed A. A. NEAVE, resigned. Mr. Casey has been connected with Treadwell for over 20 years, for the past five years in charge of sales.

NORMAN R. CLARKE has been elected vice-president and general manager of Westfield (Mass.) Mfg. Co. CHARLES J. FOGARTY has been elected secretary.

THOMAS DREVER has been elected vice-president and treasurer of New American Steel Foundries, New York City. O. E. MOUNT is secretary and assistant treasurer, and E. C. RHYMER, assistant secretary.

W. B. HOLTON JR. has been elected treasurer of Walworth Co., Boston, Mass., to succeed G. A. RICKER. JOHN M. LOVEJOY, ALLEN MARTIN, ROBERT I. LAGGREN and VERNON C. STEWART have succeeded G. A. RICKER, J. S. COONLEY, N. B. JACKSON and J. M. OLMSTEAD as members of the board.

E. P. BLANCHARD, sales manager of Bullard Co., Bridgeport, Conn., was elected to the board of directors at the Annual Stockholders' Meeting there Mar. 16. Mr. Blanchard has been connected with the company for twelve years, during which time he has held the positions of advertising manager and sales manager.

ARTHUR H. DITTMER has been re-elected president of the Dittmer Gear & Mfg. Corp., Lockport, N. Y. Other officers chosen at a recent meeting are CHARLES W. CHRISTY, vice-president, and WILLIAM F. WILLIAMS, secretary and treasurer.

GEORGE L. MOREHEAD has been elected a director of Link-Belt Co., Chicago, to succeed H. J. KIELY.

EDWARD F. NIEDECKEN, vice-president of Hoffmann & Billings Mfg. Co., Milwaukee, for 35 years, has been elected president to fill the vacancy caused by the death of FRED HOFFMANN. FRED GEZELSCHAP has been elected vice-president, and EDWARD T. HOFFMANN secretary and treasurer. Mr. Niedecken was a member of the engineering staff of Filer & Stowell Co., Milwaukee, before joining the Hoffmann & Billings Co. in 1894. Three years later he was elected vice-president.

JOSEPH H. PARSONS has been elected secretary of American Brake Shoe & Foundry Co., New York, to succeed the late GEORGE M. JUDD.

GORDON PEACH has been added to the directorate of Chicago Pneumatic Tool Co., Chicago, Ill., along with J. H. WARD, ANTHONY F. CASSIDY and W. Y. CALLAN, who were re-elected. CHARLES M. SCHWAB has resigned in line with his retirement from active participation in a number of companies. Mr. Schwab, however, remains largest stockholder in the company and his interests will be represented by Mr. Ward on the directorate.

W. G. PEARCE of New York, chairman, executive committee, American Brake Shoe & Foundry Co., has been elected a director of Bucyrus-Erie Co., South Milwaukee, Wis., to succeed the late J. R. TERBELL, who is also an official of the brake shoe company. W. W. COLEMAN, president, and other officers and directors were re-elected at the Bucyrus-Erie annual meeting.

GORDON S. RENTSCHLER, president of National City Bank, New York, has been elected a director of National Cash Register Co. to succeed EZRA M. KUHNS, who remains as secretary.

CHARLES L. WASMER has been elected president of Wasmer Bolt & Nut Co., 13,000 Athens Ave., Cleveland, O. He has resigned as chairman of the board of United Screw & Bolt Corp., Cleveland and Chicago.

GEORGE B. DRYDEN, MATTHEW KECK and S. L. INGERSOLL have been elected members of the board of directors of Borg-Warner Corp., Chicago, Ill. Mr. Dryden is a director of Central Republic Bank & Trust Co. and president of Dryden Rubber Co. Mr. Keck is secretary-treasurer of Borg-Warner Corp. Mr. Ingersoll is identified with Ingersoll Steel & Disc Co., Borg-Warner subsidiary.

WALTER BEECH, aircraft manufacturer, has resigned as vice-president of Curtiss-Wright Corp. and president of Curtiss-Wright Airplane Corp., a subsidiary, to start his own organization to build fast commercial planes. He remains one of the largest Curtiss-Wright stockholders, however.

Newly elected officers of Ross Gear & Tool Co., Lafayette, Ind., are: DAVID E. Ross, president; D. L. Ross, chairman of the board; EUGENE GRUENEWALD, vice-president and general manager; F. F. CHANDLER, vice-president and sales manager; ROY M. RESER, secretary, and A. F. KANNE, treasurer. LINN C. Ross, son of E. L. Ross, chairman of the board, has been added to the directorate.

Operating

M. WILLIAM EHRLICH, formerly manager at New York for Trane Co., La Crosse, Wis., has become chief engineer for Commodore Heaters Corp., New York.

RALPH FINK, formerly with American Stove Co., Cleveland, has joined the laboratory force of Ferro Enamel Corp., Cleveland.

LIEUT. COM. G. O. NOVILLE, former superintendent of United States Air Mail Service and engineering advisor to Admiral Byrd in the latter's exploration expeditions, has been engaged as chief consulting engineer by Fuel Oil Motors Corp., New York City.

R. VANE WOODS, formerly with Pacific Car & Foundry Co., Seattle, Wash., has joined Western Engineering Corp., Seattle.

Sales

H. R. AUDET, division manager for the past six months for General Motors Export Corp., New York, has been named Michigan manager for Greenfield (Mass.) Tap & Die Corp. He was formerly with New England Westinghouse Co., Springfield arsenal, and was at one time general manager of Geometric Tool Co., New Haven, Conn.

D. D. BARNES, formerly sales manager of Smith Engineering Works, Mil-

waukee, has joined the sales staff of H. O. Penn Machinery Co., New York, distributor for Byers Machine Co., Ravenna, Ohio.

L. O. DUNCAN, formerly sales manager and vice-president of Grand Rapids (Mich.) Store Equipment Corp. has been named sales manager at Cleveland for Ohmer Register Co., Dayton, Ohio.

A. E. GOLDIE, 561 E. 108th St., Cleveland, Ohio, has been appointed representative for Stewart industrial furnaces in the Cleveland territory by Chicago (Ill.) Flexible Shaft Co., Roosvelt Road & Central Ave.

W. W. HALL, for many years identified with Republic Steel Corp. and its predecessor has been made manager of sales for Wheatland Tube Co., Wheatland, Pa. He was formerly assistant general sales manager for Republic Iron & Steel Co.

FRANK R. WHEELER has been appointed special sales representative with headquarters at the Chicago office of Worthington Pump & Machinery Corp., Harrison, N. J. He will cover the mid-west territory, assisting the Worthington organizations in Chicago, St. Paul, Kansas City, St. Louis and Detroit.

Activities

W. J. COOK, head of the galvanizing departments of Wheeling (W. Va.) Steel Corp., celebrated his 50th anniversary in that capacity March 15.

G. H. DOHERTY, purchasing agent of USL Battery Corp., Niagara Falls, N. Y., has been elected president of Buffalo Purchasing Agents association.

H. J. FRENCH, in charge of alloy steel and iron developments for International Nickel Co., New York City, has accepted the invitation of the Board of Directors of the A.S.S.T. to deliver the Campbell Memorial Lecture at the annual meeting of the Society at its Convention in 1933. The 1932 lecture will

H. J. FRENCH

be presented by EDGAR C. BAIN, metallurgist, U. S. Steel Corp. Research Laboratories, Kearney, N. J., as previously announced. Mr. Bain's paper, the subject of which has not yet been announced, will be given in Buffalo Oct. 5.

JAMES J. MURPHY, formerly assistant secretary of National Metal Exchange, New York, has been named secretary.

E. F. ZURN, secretary-treasurer of Zurn Mfg. Co., Erie, Pa., was seriously injured recently in an automobile accident. E. M. REIGER, factory manager, and two other passengers in the car were slightly injured.

• OBITUARIES •

GEORGE J. ALTHAM, 69, a pioneer in aeronautical experiments and construction of gasoline-propelled motorcars, died Mar. 24 in Swansea, Mass. He is said to have built the second gasoline motor in this country intended for airplane use and to have built marine engines of a new design and obtained a patent on a steam turbine which he sold to Curtiss Steam Turbine Co.

BERNARD ARTHUR BEHREND, 56, internationally known consulting engineer, died suddenly at his home in Wellesley, Mass., March 25. Mr. Behrend was an inventor of machinery and large electrical units. He had been consultant to Allis-Chalmers and Westinghouse.

AGNEW T. DICE, 70, president of Reading Co. since 1918, died suddenly in Philadelphia, Pa., March 25. Mr. Dice, who started his railroad career in 1881 with the Pennsylvania, served the New York Central and Atlantic City railroads, finally going with the Reading in 1897. He was president of Philadelphia & Reading for two years.

DAVID E. DRAKE, 83, pioneer electrical engineer and friend of Thomas A. Edison, died at his home in San Diego, Calif., Mar. 23 after a brief illness. Mr. Drake went to Westinghouse Electric after spending five years in the Edison laboratories. He retired in 1924 after thirty-four years with Westinghouse, part of the time in its sales department.

HENRY F. GRIES SR., for the past 45 years accountant for A. & F. Brown Co., Elizabeth, N. J., manufacturer of power transmission machinery and castings, died there Mar. 20.

HARVEL Z. KELLY, 59, representative for National Bearing Metal Co., Pittsburgh, died at Youngstown, Ohio, Mar. 18. He had been previously connected with Falcon Bronze Co., Youngstown.

HENRY M. LELAND, 89, pioneer in the automotive industry and founder of both Cadillac and Lincoln Motor Car companies, died Mar. 26 in Detroit. He had continued actively at work until he became ill several weeks ago.

ADOLPH W. F. MANZEL, 57, member of Manzel Bros., Buffalo, manufacturer of pumps and lubricating devices, died recently there. He had been engaged in this line of manufacturing for 30 years.

LESLIE D. MILLER, 57, for 35 years head of the cost department of James B. Clow & Sons, Chicago, cast pipe and fittings, died recently in Lake Bluff, Ill.

GEORGE F. READ, retired managing director of R. Hoe & Co., Ltd., printing press manufacturers, with main offices in London, England, died in London, Mar. 17. Mr. Read was a native of Brooklyn, N. Y., and served his apprenticeship with R. Hoe & Co., Inc., New York City. He is credited with the invention of a number of new devices now employed on web presses.

GEORGE NICHOLSON, 62, vice-president and assistant general manager of Vulcan Iron Works, Wilkes-Barre, Pa., and associated with the company since the age of 18, died of heart disease, March 15, in his office in the plant.

W. E. TAYLOR, 79, formerly manager of the Republic Iron & Steel Corp., died Mar. 28, at his home in La Porte, Ind. He retired 39 years ago.

JOHN A. WESTMAN, 61 secretary and manager of Dahlstrom Metallic Door Co., Jamestown, N. Y., died there Mar. 18 following a three weeks' illness. He joined the company in 1904 and became secretary and treasurer shortly thereafter. He held these offices until the death of CHARLES P. DAHLSTROM, at which time he was made general manager, a position which he held until the time of his death.

JOHN WOODWELL, treasurer, Joseph Woodwell Co., Pittsburgh, Pa., died Mar. 14.

• MEETINGS •

AMERICAN WELDING SOCIETY
Annual meeting, Engineering Societies Bldg., New York, Apr. 27-29. William T. Spraragen, secretary, 29 W. 39th St., New York City.

FOUNDRY AND INDUSTRIAL EXPOSITION
Also 36th annual convention, American Foundrymen's Ass'n, Hotel Statler, Detroit, Mich., May 3-5. C. E. Hoyt, manager, American Foundrymen's Ass'n, Inc., 222 W. Adams St., Chicago.

AMERICAN GEAR MANUFACTURERS ASS'N
Sixteenth Annual Meeting, Hotel Statler, Cleveland, Ohio, May 12-13. Executive Committee meeting, same place, May 11. T. W. Owen, secretary, 3608 Euclid Ave., Cleveland, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS
Annual meeting, Atlantic City, June 20-24. R. E. Hess, assistant secretary, 1315 Spruce St., Philadelphia, Pa.

NATIONAL MACHINE TOOL BUILDER'S ASS'N
Third National Machine Tool Show, Cleveland (Ohio) Municipal Auditorium, Sept. 10-17. Boyd Fisher, general manager, 1415 Enquirer Bldg., 617 Vine St., Cincinnati, Ohio.

NATIONAL METAL CONGRESS & EXPOSITION
174th Regiment Armory, Buffalo, N. Y., Oct. 3-7. Sponsored by A.S.S.T., with cooperation of A.S.M.E., Institute of Metals and Iron & Steel Divisions of A.I.M.E., A.W.S., and the Wire Association. W. H. Eiseman, 7016 Euclid Ave., Cleveland, Director.

MACHINE REQUIREMENTS AND INDUSTRIAL CONSTRUCTION

Opportunities for Future Business

Calif., Sunnyvale—Bureau of Yards & Docks, Navy Department, will soon receive bids for construction of five industrial buildings at Naval Air Station.

Conn., Newington — Veterans' Administration Bureau, Washington, D. C., awarded contract for a 1 story, 41 x 60 ft. addition to garage building No. 3 at Veterans' Hospital here. Noted February 18.

Ill., Chicago—Firestone Tire & Rubber Co., c/o H. A. Platt, 1920 South Michigan Ave., awarded contract for wrecking old building for a new 1 story, 100 x 175 ft. service station at 4440 West Madison St. $50,000. Other contracts will be awarded soon. Noted February 11.

Ill., Chicago—Owner c/o J. J. Jensen, 1105 Lawrence Ave., Archt., plans completed for a 2 story, 54 x 151 ft. garage. Estimated cost $40,000.

La., Harvey—Continental Can Co., 1 Pershing Sq., New York, N. Y., awarded contract for construction of a 3 story can manufacturing plant here. $125,000. Noted February 11.

Me., Portland—Cushman Baking Co., 107 Elm St., receiving bids for construction of a 2 story garage on Lancaster St. Estimated cost $40,000. Webster & Libby, 443 Congress St., Archts.

Mass., Framingham—C. Fantony, c/o Coburnville Garage, awarded contract for construction of a 1 story, 65 x 115 ft. service garage on Waverly St. Estimated cost $40,000. Noted February 4.

Mass., Reading—Board of Selectmen, plans construction of a 1 and 2 story garage and storehouse. Estimated cost $40,000. Private plans.

Mass., Watertown—Owner, c/o H. L. Kennedy, 80 Boylston St., Boston, Archt. and Engr., awarded contract for construction of a 1 and 2 story, 40 x 150 ft. maintenance plant (electrical) here. Estimated cost $50,000.

Mo., St. Joseph — Missouri State Highway Commission, T. H. Cutler, Ch. Engr., will soon receive bids for construction of a 1 and 2 story garage and office at Highway 71 and Highway 275. Estimated cost $75,000.

Nev., Las Vegas—P. Hesse, awarded contract for construction of a 120 x 140 ft. garage. Estimated cost $40,000. Noted February 18.

N. H., Rochester—Standard Oil Co. of New York, Park Square Bldg., Boston, Mass., receiving bids for construction of a service station here. Estimated cost $25,000. Private plans.

N. J., Carlstadt—Board of Education, P. S. Clark, Boro Hall, will receive bids until April 1 for construction of a 2 story grade and junior high school including manual training rooms, etc., on Washington St. Estimated cost $150,000. George F. Bial, 241 Bell Ave., Hasbrouck Heights, Archt.

N. J., Little Falls—Little Falls Laundry Co., East Main St., will receive bids about May 15 for construction of a 2 story, 140 x 280 ft. garage on Main St. Estimated cost $175,000. F. W. Wentworth, 140 Market St., Paterson, Archt. O. E. Goldschmidt, 110 West 40th St., New York, N. Y., Mech. Engr. Noted January 14.

N. Y., Brooklyn—J. Farrell, 101 3rd Ave., will build a 2 story addition to service garage at Bergen St. and Third Ave. O. B. Almgren, 8605 3rd Ave., Archt. Work will be done by separate contracts. Maturity late summer. Noted March 10.

N. Y., Brooklyn—Ojay Realty Corp., Kings Highway and West 13th St., will receive bids about July 1 for construction of a 2 story, 72 x 105 ft. service garage and gas station. Estimated cost $50,000. H. J. Nurick, 930 Putnam Ave., Archt.

N. Y., Brooklyn—Sondero & Schiffino, 426 4th St., will receive bids about August 1 for construction of a 2 story, 50 x 96 ft. service garage at 18th Ave. and Rutherford Pl. Burke & Olsen, 32 Court St., Archts. Noted March 10.

N. Y., New York—Irving Kudroff, 15 West 38th St., Archt., receiving bids for construction of a 1 story, 25 x 200 ft. garage, storage building, etc. at 437 East 23rd St. for G. Trani Inc., 413 East 23rd St.

N. Y., New York—William Peat, 2436 Grand Concourse, will build a 2 story, 100 x 150 ft. service garage at 416 West 204th St. Estimated cost to exceed $40,000. S. J. Kessler, 125 West 45th St., Archt. Work will be done by separate contracts. Noted March 3.

O., Cleveland — Sabin Machine Co., H. B. Sabin, Pres., 6538 Carnegie Ave., plans construction of a 1 story addition to factory at 6601 Cedar Ave. Estimated cost $40,000. H. M. Morse Co., 736 Prospect Ave., Archts. and Engrs.

Pennsylvania — Combined School Districts, c/o J. F. Kaufmann, Chn., Duncansville, plans construction of a vocational high school between Duncansville and Hollidaysburg. Estimated cost $175,000. Architect not selected.

Pa., Brodheadsville — National Portland Cement Co., Finance Bldg., Philadelphia, will build a cement plant, power house and shops here. Estimated cost $2,000,000. Work will be done by separate contracts. Maturity indefinite. A. P. Houser, Emaus, in charge.

Pa., Edgley—Paterson Parchment Paper Co., 33 8th St., Passaic, N. J., awarded general contract for construction of a 2 story, 90 x 200 ft. paper manufacturing plant at State Road and Delaware River here. Estimated cost $40,000. Noted March 10.

Pa., Erie—Erie Casket Co., W. C. Kibler, Pres., 1901 Sassafras St. having plans prepared for construction of a factory. Estimated cost $40,000. Meyers & Johnson, 821 Commerce Bldg., Archts., Mayer & Valentine, 300 Plymouth Bldg., Cleveland, O., Engrs.

Pa., Erie — Hammermill Paper Co., c/o H. Schatain, East Lake Road, will receive bids until April 4 for construction of a 1 story, 130 x 260 ft. factory building. Estimated cost $100,000. Private plans.

Pa., Greenville—Greenville Steel Car Co., considering plans for rebuilding machine shop and pattern works destroyed by fire. Loss $50,000.

Pa., Washington—Washington Tin Plate Co., B. F. Brehl, V. Pres., Woodland Ave., awarded general contract for construction of a 1 story, 50 x 100 ft. machine shop.

R. I., Cranston—Service Battery Shop, 263 Broadway, receiving bids for construction of a 1 story service station and showroom on Station St. Estimated cost $40,000. F. Chiaverini, 32 Broadway, Providence, Archt.

Tenn., Memphis—Sears, Roebuck & Co., North Parkway and Watkins St., plans addition to service station of mail order plant at North Cleveland and Austin Ave.

Tex., Orange—Commercial Pulp & Paper Co., headed by S. M. Bump, Orange, purchased properties of Yellow Pine Paper Mill and plans renovating and repairing paper mill including new equipment. Estimated cost $75,000. Work will be done by owners forces. C. A. Kieren, Supt.

Alta., Edmonton — Van Valkenburg Aircraft Co., Ltd., Edward Berg, Pres., plans construction of a plant for the manufacture of airplanes and parts. Estimated cost $75,000.

B. C., Prince Rupert — F. L. Buckley, 510 Hastings St., Vancouver, plans establishment of a bleached Swedish sulphite pulp mill here, 200 ton capacity, using approximately 700,000 ft. of logs daily.

Man., Winnipeg — Winnipeg Public School Board, F. A. Allden, Secy., William and Ellen Sts., plans construction of a technical high school. Estimated cost $500,000.

Ontario—Eldorado Gold Mines Ltd., 319 Bay St., Toronto, plans construction of a refinery for extraction of radium from Great Bear Lake including crushing and grinding machinery, chemical equipment, etc. A. N. Pochon, c/o owner, Archt.

Ont., Osnabruck Centre — J. Miller, Cornwall, plans erection of a saw and grist mill here. Estimated cost $25,000.

Ont., York—McQuay-Norris Manufacturing Co., 37 Pearl St., Toronto, awarded contract for construction of a 1 story factory for the manufacture of piston rings at Ray and Goddard Aves., here. Estimated cost $50,000 to $60,000.

Que., Metane—Lucien Cote, plans construction of a sash and window factory. Estimated cost $15,000.

Equipment Wanted

D. C., Washington—Bureau of Supplies & Accounts, Navy Department, will receive bids until April 19 for four motor driven pipe cutting and threading machines and spares for Navy Yards, Brooklyn, N. Y., Philadelphia, Pa., Mare Island, Calif. and Puget Sound, Wash. Sch. 7759.

Pa., Frankford (sta. Philadelphia)—Ordnance Dept., Commanding Officer, Frankford Arsenal—will receive bids until April 4 for automatic screw cutting machine, motor driven. Cir. 399.

Pa., Philadelphia—Bureau of Supplies & Accounts, Navy Department, Washington, D. C.—will receive bids until April 5 for two motor driven drilling and tapping machines for Navy Yard here. Sch. 7739.

B. C., New Westminster—Westminster Iron Work Ltd.—machinery and equipment for proposed plate shop, blacksmith shop and pattern shop.

Que., Gogama—Poupore Lumber Co.—sawmill machinery.

Sask., Beatty—Robert Horne—12 in. grinder.

Sask., Porcupine Plain—John Moore—saw carriage and other equipment.